INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 1
JANUARY 1944

Subscription : Rs. 6 per annum : 8 as. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS, CAWNPORE

ICAR—21.1.44
2,200

CONTENTS

Articles, photographs, books and periodicals for review and editorial communications should be addressed to the Editor, Imperial Council of Agricultural Research, New Delhi.

The subscription is Rs. 6 per annum, 8 as. per copy, inclusive of packing and Indian postage. Enquiries and remittances relating to subscriptions and advertisements should be made to the Manager of Publications, Civil Lines, Delhi.

Subscribers in Europe and America should apply to the High Commissioner for India, Public Department, (Publication Branch), India House, Aldwych, London, W.C. 2.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 2
FEBRUARY 1944

Subscription : Rs. 6 per annum : 8 as. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS, CAWNPORE

ICAR—21.2.44
2,300

CONTENTS

Any article or illustration in the magazine may be reproduced or translated in any registered newspaper or periodical without special permission, provided the source is acknowledged in each case. A copy of the newspaper or periodical containing the article or illustration should be sent to the Editor.

The Imperial Council of Agricultural Research does not accept responsibility for opinions or statements contained in contributed articles or in advertisements in this magazine.

Articles, photographs, books and periodicals for review and editorial communications should be addressed to the Editor, Imperial Council of Agricultural Research, New Delhi.

The subscription is Rs. 6 per annum, 8 as. per copy, inclusive of packing and Indian postage. Enquiries and remittances relating to subscriptions and advertisements should be made to the Manager of Publications, Civil Lines, Delhi.

Subscribers in Europe and America should apply to the High Commissioner for India, Public Department (Publication Branch), India House, Aldwych, London, W.C. 2.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 3
MARCH 1944

Subscription : Rs. 6 per annum : 8 as. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS, CAWNPORE

ICAR—21.3.44
2,300

CONTENTS

Articles, photographs, books and periodicals for review and editorial communications should be addressed to the Editor, Imperial Council of Agricultural Research, New Delhi.

The subscription is Rs. 6 per annum, 8 as. per copy, inclusive of packing and Indian postage. Enquiries and remittances relating to subscriptions and advertisements should be made to the Manager of Publications, Civil Lines, Delhi.

Subscribers in Europe and America should apply to the High Commissioner for India, Public Department, (Publication Branch), India House, Aldwych, London, W.C. 2

ICAR—21-1-44.
2,300

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 4
APRIL 1944

Subscription : Rs. 6 per annum : 8 as. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE GOVERNMENT OF INDIA PRESS, SIMLA

CONTENTS

Articles, photographs, books and periodicals for review and editorial communications should be addressed to the Editor, Imperial Council of Agricultural Research, New Delhi.

The subscription is Rs. 6 per annum, 8 as. per copy, inclusive of packing and Indian postage. Enquiries and remittances relating to subscriptions and advertisements should be made to the Manager of Publications, Civil Lines, Delhi.

Subscribers in Europe and America should apply to the High Commissioner for India, Public Department, (Publication Branch), India House, Aldwych, London, W.C. 2.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 5
MAY 1944

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS, CAWNPORE

ICAR—21.5.44
2,300

CONTENTS

Articles, photographs, books and periodicals for review and editorial communications should be addressed to the Editor, Imperial Council of Agricultural Research, New Delhi.

The subscription is Rs. 6 per annum, 8 as. per copy, inclusive of packing and India postage. Enquiries and remittances relating to subscriptions and advertisements should be made to the Manager of Publications, Civil Lines, Delhi.

Subscribers in Europe and America should apply to the High Commissioner for India, Public Department (Publication Branch), India House, Aldwych, London, W.C.2.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 6
JUNE 1944

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS, CAWNPORE

ICAR—21.6.44
2,300

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V JANUARY 1944 No. 1

THE NEED FOR MORE MILK

INDIA produces about 800,000,000 md. of milk a year. This is the second largest production in the world, being next to that of the United States. Despite this, the quantity is so small *per capita* of the human population that each person gets only about 7 oz. of milk or its equivalent in milk products daily on an average, whereas the people of the United States get nearly 35 oz. daily. Nutritionists indicate that the minimum amount of milk in the average diet should be about 32 oz. for growing children and half this much for adults. The people of many of the countries of the world get sufficient to meet the needs of their bodies as indicated by those studying human dietary needs. We certainly do not.

The total production of milk in this country constitutes about 625 lb. per producing cow, excluding what the calf gets. If the average production of our cows was increased three times, the milk then produced would provide the minimum for the needs of our people. This would require the same number of cows, each producing 1,875 lb. yearly, giving a total of 2,400,000,000 md. Although this would meet the minimum needs of the population, our cows would even then not be producing the quantity of milk that is produced on the average by cows in other countries, which varies between 3,500 and 4,000 lb. in Canada, England, the United States and certain other countries. In Denmark we are told that the average production per cow before the war was over 8,000 lb. a year.

India cannot increase her cattle population three times because she cannot possibly feed them. In fact, it is not possible to give those we already have the proper amount and kind of feed. It is estimated that all fodder, grass and farm waste material of which the cattle make use provide an average of about 4·6 lb. of dry matter per day for each cow, whereas an animal with a body-weight of 600 lb. requires 8 lb. of dry matter in the feed daily for proper maintenance only. This is exclusive of what is required for work or milk production, which varies with the amount and kind of work that is being done and the amount and quality of milk being produced. It is also exclusive of the needs of pregnancy. Our cattle are now fed about, if not less than, one-half enough as it is. If the cattle population increases to any extent, the production of feed for them would have to be increased or the result would be a greater degree of starvation. Such conditions could be prevented only by increased efficiency in the conversion of feed into milk on the part of our cattle. It is extremely questionable, however, whether the efficiency of conversion of food energy in the form of fodder and grains into food energy in the form of milk could be increased in our cattle three times to provide the human population with the minimum milk on the existing amount of cattle feed. Obviously we must increase both the efficiency of our cattle and the production of feed for them. These two aspects of the problem are inseparable and will remain so.

The majority of the population of this country consists of village or farm people and working people. These are people who are getting milk in quantities that are much smaller than the educated and higher-paid classes. Since most of these persons are in the villages it is there that the greatest need for this increased amount of milk is found.

Briefly, our need for milk is at least three times the present supply. Any increase up to nearly if not fully three times the present supply could and should be absorbed outside the present organized markets, or in markets that are not now organized but might become

so. To do this it will be necessary both to produce more cattle feed and to increase the efficiency of our milk-producing animals.

No country in the world has such an opportunity before it in the development of its cattle and dairy industries and few countries need to take advantage of this opportunity more than India. This is a challenge to those interested in national or public health and human nutrition, to those interested in the production of milk or the manufacture of milk products, to those interested in the welfare of our village and working people, to those concerned about the health of fellow-members of their community or family, in fact to almost everyone, in the country. Many of us can play a small part in this problem. Having realized the necessity of providing more food in the form of milk and its products, it is morally wrong for us to ignore or even neglect the matter.

WILLIAM BURNS

C.I.E., D.Sc.

An Appreciation

IN the retirement of Dr William Burns, Agricultural Commissioner with the Government of India, India lost the services of a scientist who gave of his best for the advancement of Indian agriculture through education, research and development over a period of years equalled by few agricultural officers. Educated at Montrose Academy and the University of Edinburgh where he graduated B.Sc. in 1907 with distinction in Botany, he started his career as an assistant lecturer at the University College of Reading (now Reading University), under Sir Frederick Keeble, Professor of Botany. In 1908 Dr Burns joined the Indian Agricultural Service, and was appointed Professor of Botany at the College of Agriculture, Poona and Economic Botanist to the Government of Bombay. One of his earliest and most fruitful innovations in the teaching of agriculture was the introduction of plant genetics into the curriculum. Dr Burns threw himself heart and soul not only into the teaching of his students, but also into their physical well-being. He introduced boxing and volley-ball, played for the college hockey team and introduced and captained a physical training system.

Dr Burns became an officer of the Poona Volunteer Rifles in 1910 and commanded the machine-gun section. He was later a member of the Mounted Infantry Section commanded by the late Major P. C. Wren, author of *Beau Geste* and other works. During the Great War he was first a member of the Auxiliary Force and then of the Indian Army Officers' Corps in which capacity he underwent an Officers' Training course in Poona and a musketry course in Satara. He was then posted to the 114th Mahrattas and commanded the Poona Divisional School of Musketry until January 1919, when he was demobilized.

During his service in Bombay, Dr Burns submitted a thesis on mango inflorescence for which he was awarded the degree of D.Sc. of the University of Edinburgh in 1914. He acted as Principal of the Poona Agricultural College on various occasions and was finally made permanent in 1922. In 1926 he was appointed Joint Director and in 1933 Director of Agriculture, Bombay. He represented India at a number of international gatherings of scientists. As a delegate from India he attended the International Botanical Congress at Cambridge, the Imperial Botanical Conference and the International Horticultural Congress in 1930, the International Botanical Congress at Amsterdam and the International Cotton Congress at Rome in 1935. An energetic worker with a wide range of interests, Dr Burns was a prolific writer and contributed to various journals articles on economic botany, ecology, grassland improvement and plant diseases. He edited Firminger's *Gardening in India* and wrote *Reader's and Teacher's Handbook in Nature Study* for the 'Matter and Life' series published by Messrs Longmans Green and Co.

Dr Burns served on the Senate of the University of Bombay, the Indian Central Cotton Committee, the Indian Central Jute Committee, the Indian Lac Committee, the Indian Coffee Market Expansion Board and similar research bodies. He was twice elected President of the Indian Society of Plant Breeding and Genetics and this year he delivered the Presidential address to the Society in Delhi on the teaching of plant

W. Burns, C.I.E., D.Sc.
Late Agricultural Commissioner with the Government of India

PLATE 1

genetics, a subject in which he was specially interested from his early days.

In 1936 Dr Burns was appointed Agricultural Expert with the Imperial Council of Agricultural Research the title later being changed to Agricultural Commissioner with the Government of India. In this capacity he was provided with further opportunities of expanding his activities in two important directions, one literary, the other oratorical. He originated a series of illustrated articles on Indian cultivators, entitled *Sons of the Soil*, which attracted attention when they appeared in *Agriculture and Livestock in India*, and were an instantaneous success when published in book form in 1941. The literary quality of his own contribution to the book was noted by many reviewers and actually this was conspicuous in his writing throughout his career. One of his most successful innovations was the publication of a more popular magazine for farmers in the place of *Agriculture and Livestock in India*, which had held the stage for some years. With the publication of the first number of INDIAN FARMING a new era in agricultural journalism in India commenced, and this magazine, to which Dr Burns has been a regular contributor as well as part-editor, is now thoroughly well established. He was awarded the honour of C.I.E. in January 1936.

As chairman of committees or as leader on the crops and soil side of agriculture and at larger meetings Dr Burns will long be remembered for his incisive summing up of a discussion or a situation.

In their retirement in their native heath Dr and Mrs Burns carry with them the best wishes of their many friends and colleagues in India.

HIGH POINTS AT FOOD CONFERENCE TOLD BY DR BARTON

DR G. S. H. BARTON, Dominion Deputy Minister of Agriculture, who was chairman of the Canadian delegation at the United Nations Food Conference held recently at Hot Springs, Va., said in an address given in Ottawa that food and agriculture were given first place in post-war national and international affairs at the Conference.

"Never before had food and agriculture had such recognition" he said. "Never before had it been so clearly and widely established that better diets and improved agriculture were so fundamental to the well-being of all people, and never before had the problems of world distribution of food been internationally explored so critically and with such scope."

Four main subjects were dealt with at the conference :—nutrition, production, distribution and recommendations for continuing the work of the Conference. Concerning nutrition, Dr Barton said it was generally recognized that there had never been enough food produced in the world to maintain the health of all its peoples.

The Production Committee, after a general review of the post-war period agreed that at that time there were three periods for principal consideration ; the short-term period—one of shortages ; the transition period and the long-term period—the future. It was emphasized by the Committee in its report that the necessary production contemplated should not be expected unless a fair return to those who produce the food can be assured.

The Committee on distribution laid down that in order to assist and improve distribution to attain freedom from want, the Conference should regard international security and effective collaboration among nations as of first importance. The first cause of hunger and malnutrition is poverty, stated the Committee.

Dr Barton said that the Conference was called to consider post-war problems with respect to food and agriculture and all the deliberations and recommendations were held and made with the purpose that while the war is on, its requirements must receive first consideration.

The findings and recommendations of the Conference should constitute an important document for the consideration and action of the governments of the 45 countries represented, said Dr Barton.—*Department of Agriculture, Canada.*

Original Articles

FIGHTING FAMINE AND SCARCITY IN BOMBAY

By W. J. Jenkins, C.I.E.; M.A., B.Sc.
Director of Agriculture, Bombay Province

In the province of Bombay, a total area of approximately 29 million acres is put under cultivated crops annually. Of this immense cropped area, only a little over one million acres is under artificial irrigation from canals, tanks, or wells. Accordingly, by far the greater proportion of crop production in the province is solely dependent upon the sufficiency and effectiveness of the monsoon rains. Unfortunately, in many tracts, particularly in the southern, central and eastern districts, the annual rainfall is uncertain in quantity and often badly distributed as regards crop requirements throughout the year. It is estimated that, on an average, seasons of partial or total failure of crops, due to inadequate or maldistributed rainfall, occur about twice every four years over the Bombay Deccan and once every three years over large areas of Gujarat and the Karnatak. Hardly one year passes without reports of insufficient rains, and consequent crop deterioration or failure, being received from some unfortunate areas of the province. As can well be imagined, the economic loss to the cultivators and to the province as a whole resulting from such frequent and recurrent crop failures is immense and to this must be added the immeasurable distress and suffering caused by the human and livestock populations in regions affected by 'scarcity' conditions.

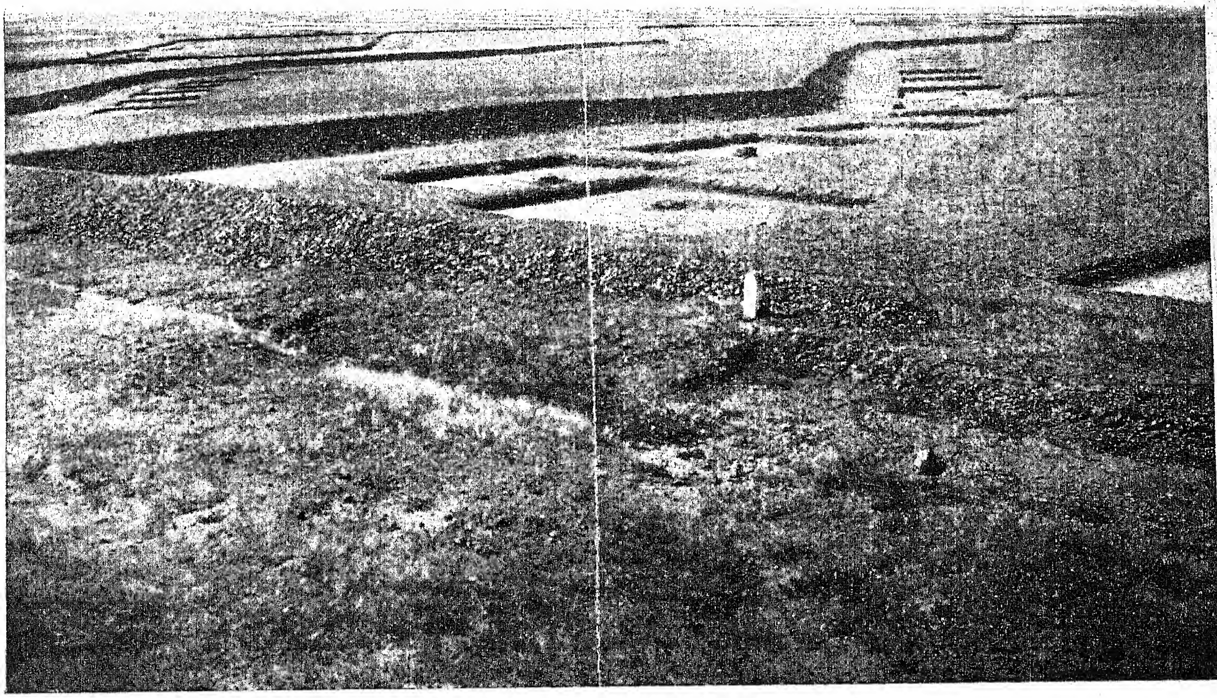
Twofold problem

In the areas which are most susceptible to failure or scarcity of rainfall, viz. Ahmednagar, Sholapur and parts of Satara and Poona districts in the Deccan, the Broach and Panch Mahals district in Gujarat and Bijapur district and parts of Dharwar and Belgaum districts in the Karnatak, the problem of soil erosion is of very great importance. In these tracts, the monsoon season is often characterized by very heavy downpours of rain of very short duration. Such precipitations are of little use in crop cultivation and production but they cause evergrowing damage by denuding the sloping lands of their covering of soil and by washing down the fertile upper layers of the fields to irrecoverable loss in *nullahs* and rivers. In the Deccan, the barren and soilless hill slopes and the grim gullies which ramify throughout the agricultural land bear silent witness to the processes through which the life-blood of agriculture is being slowly drained away. At Sholapur, it has been proved that the loss of soil by erosion on unprotected fields is often as high as 50 tons per acre annually and may actually go as high as 130 tons of fertile soil per acre in a single year.

The problem which faces the Agricultural Department in these 'scarcity' tracts of the Bombay Province is therefore of a two-fold nature. In the first place, it has been necessary to work out a scientific system of dry farming whereby crops can be grown with a fair measure of success in years in which the annual rainfall is scanty and badly distributed. Secondly, the immense losses of the cultivators' main capital, the soil, which result from the continuous erosion by rainwater after heavy and untimely precipitations, must be checked and the necessary measures taken not only to prevent such losses but also to restore and retain the fertile upper soil layers which constitute the agriculturists' 'crop factory'.

Bombay dry farming system

Scientific research into the problems of dry farming has occupied the attention of agricultural scientists for many years and in all parts of the world. In the province of Bombay, it has been carried on during the past decade at the Dry Farming Research Stations at Sholapur and Bijapur situated in the centres of two districts which have an unwelcome reputation for crop scarcities and failure due to inadequate or ill-distributed rainfall in the monsoon seasons. This work has been financed jointly by the Imperial Council of Agricultural Research and the Government of Bombay and

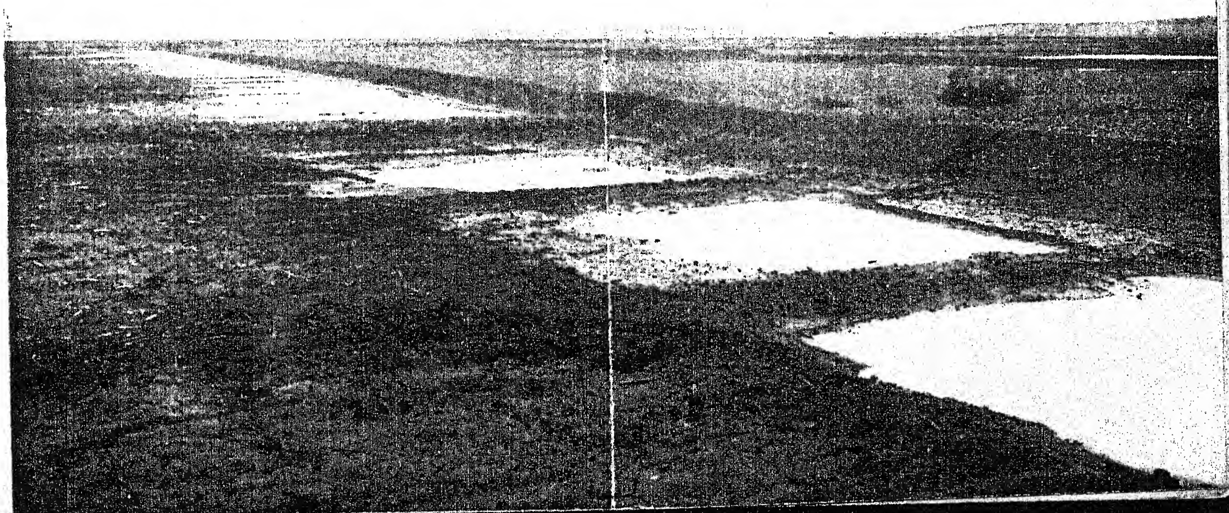


Contour bunded area near Indi, Bijapur district. (Note borrow pits which are rapidly silting up)

[*Photos by P. D. Haldankar*

PLATE 2

Contour bunds holding up rain water after heavy rainfall at Chhabi, Bijapur district.



Bird's eye view of contour bunded area at Gowankop, Bijapur district (Note rain-water held up along contour bunds after heavy rainfall).

[*Photos by P. D. Haldankar*

PLATE 3

Contour bund construction at Gowankop, Bijapur district after heavy rainfall. (Note absence of breaches in bund and rain-water held up along bund line)

is still in progress. The results so far obtained, however, have shown beyond all shadow of doubt that many crop failures due to inadequate rainfall under local conditions of precipitation in the affected areas could have been avoided. It has been clearly demonstrated that, even in seasons when the rains prove scanty and untimely, crops can be grown successfully by simple and inexpensive modifications in the existing local technique of cultivation as practised by the local agriculturists. The results of these investigations have been embodied in the Bombay Dry Farming System, which is a simple system of land preparation, tillage and crop cultivation designed with the main object of conserving as much as possible of the available rainfall in the soil and of retaining it there for use by the growing crops over as long a period of time as is necessary for their development to full growth.

Improved cultivation

The main factors involved in the Bombay Dry Farming System are (a) simple field *bunding* along the contours of the cultivated areas, (b) modifications in the local agricultural practices in connection with ploughing and harrowing of the land, sowing the seed and interculturing the young growing crops, (c) the extension of manuring, especially green manuring, (d) the introduction of scientific methods of crop rotation and of judicious fallowing of cultivable fields and (e) the cultivation of drought-resistant varieties of the major crops. It will not be possible to give details of the component factors of the system within the scope of this article, but a detailed leaflet[1] on this subject has been prepared by the Bombay Department of Agriculture and copies will be supplied free on application being made to the Director of Agriculture, Bombay Province. The advantages of the Bombay Dry Farming System in its application to crop production in scarcity areas are clearly shown by the results obtained at Sholapur and Bijapur during the past nine years where comparative trials of the improved system of cultivation and of the ordinary local method have been conducted on a field scale. During the period of these field tests, the average outturns per acre of *jowar* grain and *jowar kadbi* were 238 lb. grain and 447 lb. *kadbi* per annum from the area cultivated according to the Bombay Dry Farming System, whereas the area cultivated according to existing local practices yielded an annual average of 89 lb. grain and 256 lb. *kadbi* only. These results were obtained on the shallower soils at Sholapur but, on the more limey and deeper soils at Bijapur, the value of the scientific methods of crop production involved in the Bombay Dry Farming System was even more marked. The area under the improved system gave an average yield per annum of 445 lb. *jowar* grain and 623 lb. *jowar kadbi* as compared with yields averaging 224 lb. grain and 406 lb. *kadbi* on adjoining fields cultivated in accordance with common local agricultural practices. In 1936-37, which was an year of great scarcity over the whole of Bijapur district, fields cultivated in accordance with the Bombay Dry Farming System yielded under the most adverse conditions, i.e. a total rainfall of 13·24 in. or 60 per cent of normal, 490 lb. *jowar* grain and 711 lb. *jowar kadbi* per acre. The economic advantages of the improved dry farming system have also been worked out and the additional net profit to the cultivator varies from 8 annas to Rs. 5 per acre according to type of soil, climatic conditions, etc., in the areas in which it has been adopted.

Contour bunding 1791

It has been mentioned above that one of the component factors of the Bombay Dry Farming System is simple field *bunding* along the contour of the cultivated areas. At a very early stage of the scientific research at Sholapur and Bijapur, it became quite evident that some form of field *bunding* was essential in any effective system of dry farming in order to assist in retaining rainfall in the land and to check loss of water and soil by erosion. For many years past, the Agricultural Department had been experimenting and testing different types of field *bunding* in many districts of the province and much interest had been shown by the cultivators, especially in the 'scarcity' areas, in this type of work. Indeed, the construction of field *bunds* was no new development in many of these areas as, in the past, a considerable number of such *bunds* had been erected by cultivators on their own initiative and at their own cost. The great majority of these *bunds*, however, were earthworks of considerable size constructed at the lowermost end of large fields, and, in many cases, provided with masonry or stone waste weirs to

[1] Leaflet No. 5 of 1942, 'The Bombay Dry Farming System of Cultivation. What it means and how cultivators can adopt it on their own lands' (Bombay Department of Agriculture, Poona).

provide for the escape of the large quantities of surplus rainfall which flowed down from the upper slopes. Such *bunds* were of the nature of 'flooding' schemes and, in the majority of cases, were constructed by individuals with no reference to their effect on neighbouring lands and with little, if any, relation to the general contours of the surrounding area. Moreover they were expensive to erect and maintain and, in periods of heavy and concentrated rainfall, generally gave way under the pressure of surface run-off resulting in aggravated damage by erosion to the fields lower down.

In the year 1942-43, Bijapur district was once again in the throes of a severe famine. The monsoon of June-July had proved inadequate and insufficient and the late monsoon rains of September-October upon which the district mainly relies for crop production of *rabi* had failed completely. Work had to be found for the famine stricken people who flocked to relief centres for employment and food. It was against this background of general distress and want that the Government of Bombay sanctioned a large scale experiment in contour *bunding* in the districts of Bijapur and Sholapur on the advice of its agricultural experts. The Land Development Section of the Agricultural Department was strengthened by the establishment of a charge known as 'Scarcity Areas' which was entrusted to Mr V. A. N. Sausman of the Bombay Forest Service, who had studied anti-erosion measures in the Punjab. The Agricultural Department prepared plans for large-scale contour bunding on an experimental basis, mainly in Bijapur district, where large number of famine labourers were available and, in which district, the results of such experimental work, if successful, would be of the most immediate and paramount importance. The experimental nature of the scheme consisted of large-scale investigations into technical aspects of contour *bunding*, e.g. the height and width of the contour bunds, the optimum distance, i.e. fall between adjacent bunds and the most economical methods of construction. This work was—and still is—being done at the entire cost of Government partly to provide suitable constructive work for famine labour and partly to enable the effects and economies of much protective works to be fully established over large areas, generally comprising entire watersheds and, including within their scope, all areas both cultivated and uncultivated falling within such water sheds.

Bijapur experiments

The large-scale experimental work on contour bunding under the Land Development Section of the Agricultural Department was commenced in April 1943. Up-to-date i.e. 15 October 1943, this work has been completed over a total area of 80,000 acres divided among 28 large-scale bunding 'projects' in Bijapur district alone. The total protected area mentioned above includes 15,000 acres of forest and waste lands, generally found at the top of the water sheds which have been contour-trenched in a modification of the Gradoni system of land reclamation and which are being reafforested with suitable types of tree growth. In Bijapur district, the area of agricultural land now protected by contour bunding under the scheme exceeds 65,000 acres. More than 2,000 miles of contour bunds have already been erected and this total is being added to daily at the rate of roughly 30 miles of bunds, i.e. 1,000 acres protected, per day. To begin with, the number of famine labourers employed on the works was 4,600 in May 1943. This figure increased to its maximum in August 1943 when 39,000 labourers were engaged on the construction of contour bunds. At present, the labour strength has declined to 33,000 as a result of the very favourable rains in September-October 1943, which resulted in numbers of famine victims returning to the cultivation of their own lands on the return of better conditions. At a rough estimate, the construction work of contour bunds done up-to-date has involved 200 million cubic feet of earth-work. On the reafforested areas, large numbers of young seedling trees have been planted out by the staff engaged on this section of the work over an area of about 2,000 acres.

Similar large-scale experimental work in Sholapur district has been completed over an area of above 3,000 acres.

The work outlined in the preceding paragraph is still in progress and it is anticipated that over 1,75,000 acres will be fully contour bunded by the close of the current financial year, i.e. by the end of March, 1944. The results so far achieved indicate that contour bunds with a base of 8 ft. and a height of 3 ft. spaced at every 3 ft. drop in level over the entire area of a watershed will be the most effective and economical method of dealing with the anti-erosion problem in all parts of the province which can be included in the term 'scarcity areas', i.e. with an annual rainfall varying from 15 in. to 24 in. Such a system of contour bunding does not require the

provision of waste-weirs in the bunds as the 'compartmentation' of the area by the contour bunds has proved adequate to hold the rainfall and enable it to be gradually absorbed into the sub-soil layers. During the period from 15 September to 15 October 1943, there was an almost unprecedented rainfall totalling over 15 in. in Bijapur district and several precipitations exceeded 6 in. in 24 hours but, practically without exception, the system of contour bunds constructed by the Land Development Section, held up all surface run-off and remained unbreached under this exceptional test. The actual cost of the work is not yet fully worked out but, from such data as are now available, it is estimated that it should not exceed Rs. 12 per acre over the whole protected area in Bijapur district. The super-imposition of the Bombay Dry Farming System of cultivation on the contour bunded areas is now being undertaken and a special staff for this purpose is being built up as part and parcel of the Land Development Section.

Optimistic future

In view of the accumulated experience now available, it does not appear unduly optimistic to suggest that contour bunding on scientific lines plus the introduction and expansion of the Bombay Dry Farming System over the contour bunded cultivable areas, and the contour trenching and reafforestation of the non-cultivable areas, appear to offer an effective and economic solution to the problem of recurrent famine and scarcity which is so acute in many parts of the Bombay province. That this view is held by a great majority of the cultivators in these areas is apparent from the enthusiastic cooperation which they have shown in the work of the Land Development Section during the period in which the work described above has been in progress in Bijapur district. Visiting experts have also expressed the view that the type of work in progress offers the only solution to the problem being dealt with and though the exceptionally favourable monsoons of the current year may mask the full effects of the measures taken, those responsible for the work wait with full confidence the test of its effectiveness in years to come.

Finally, it may be stated that the Government of Bombay has taken all necessary measures required to ensure the permanence and continued maintenance of the widespread protective contour bunding work done by the Agricultural Department. The Land Improvement Schemes Act, 1942, provides legal machinery to ensure the regular repairs and maintenance of the contour bunds, etc., by the land-owners upon whose lands they have been constructed and who will benefit from them. The Cattle Trespass Act, 1871, has been applied to the reafforested areas within the contour bunding projects in order to reduce the risk of damage to the young trees by wandering herds of goats and other livestock. In the future, it will obviously not be possible for Government to carry out such extensive works entirely at its own cost and it is reasonable to anticipate that the land-owners should themselves be prepared to bear a share of the expenditure involved in such large-scale contour bunding projects. It is the intention of Government to make such contributions from the land-owners as little a burden on them as possible, e.g. by spreading out payments over a number of years, etc., and there is every reason to expect that very few, indeed, of the cultivators in the 'scarcity areas' of the province will hesitate to cooperate with their fellow agriculturists and with Government in the extension of measures which appear to be certain to remove permanently the ever-threatening spectre of famine and want from their fields and villages.

PUBLIC HEALTH FISH FARMING

By T. J. Job, D.Sc.

Lady Tata Memorial Research Scholar, Laboratories of the Department of Fisheries, Bengal

The importance of fishes in the national economy, in dietetics and pharmacology is increasingly being recognized. But there is a fresh aspect, dealing with the utility of fishes in their live condition—a new scheme of anti-disease pisciculture.

Ever since a certain Dr Fort, in 1854, freed a tank in Georgia in the United States of all its mosquito larvae by placing in it some small fish, several observations made in various parts of the world have testified to the utility of larvicidal fishes. It has been possible to establish definitely the efficacy of certain fishes in the destruction of disease-transmitting organisms like mosquitoes and cyclops. Fishes have also been noted to be of value in the control of certain other noxious helminths such as the flukes and have considerable bearing on the general sanitation of various types of waters.

Mosquito control

As the transmitting agents of malaria, filariasis, dengue, yellow fever and encephalitis, mosquitoes have been recognized to be one of the worst of man's enemies. According to Dr Balfour's estimate, the annual death roll from malaria alone is 200 millions, while the yearly loss to the world is more than £ 50 millions. Except for areas 5,000 ft. above sea-level and a few widely separated regions such as a portion of the Brahmaputra valley in Assam, parts of Eastern Bengal and a few limited districts of the Madras province, the remaining parts of India are all subject to the depradations of the disease. Besides, the high fatality attending it, especially in its epidemic form, the debility, poverty and apathy caused are factors seriously retarding national progress. Filariasis is another infliction common to a greater or less extent in many tropical countries and is transmitted by several of the common mosquitoes. Dengue, which is a one-week fever frequent in this country near the ports, is often attended with painful after-effects, and is transmitted by common mosquitoes. Recently mosquitoes have been discovered to be capable of transmitting the new 'sleeping sickness', acute encephalitis, also. All the above-mentioned diseases are preventable. In the case of malaria, filariasis, dengue, yellow fever, etc. the mosquito is the connecting link between the disease germ and man, and therefore mosquito control is the surest way to break this biological chain, and thereby eradicate the disease.

It is difficult to destroy mosquitoes on a comprehensive scale in the winged or adult stage. Direct destruction by the use of hand-nets, swatters, chloroform tubes, traps, fumigation, spraying, etc. have had but limited success.

Larvicidal fishes

Biological control by suitable larvicidal fishes is a method that seems one of the most practical and can be practised by the poorest villager if properly instructed. It has been found that under suitable conditions, control by fish is more efficient and at the same time far less expensive than by chemicals. Therefore, it can be widely applied in this country where poverty is proverbial and the incidence of malaria is the greatest in the world. Mosquito larvae are much relished by fish. Thomas has considered them as the mainspring of fish life in India. Most small fishes and the young stages of large ones may, when hungry, consume mosquito larvae if the latter are at hand, and a fairly long list of probable larvicidal fishes all of which are of some value is available. However, select species with proved utility will alone be of practical use in anti-mosquito campaigns. They should be small, active, hardy, prolific, and topfeeding carnivores which will prefer a diet of mosquito larvae in virtue of the latter's convenient size, suitable pose of rest at the surface, sufficient motility, absence of obnoxious exoskeleton, palatable nature and easy availability. Of course, only fresh and brackish water fishes can be utilized, since mosquito-breeding is practically confined to such waters.

From the point of view of mosquitocidal

activity these fishes fall into groups according to their efficiency :

1. Typical surface feeders (such as *Aplocheilus* and *Gambusia*), which are prime, 'mosquito-fish' satisfying the necessary requisites and hence highly efficient for control work.

2. Those (like *Oryzias*, *Lebistes*, *Aphanius* and *Horaichthys*), which also are surface feeders, but owing to their mode of life are less efficient.

3. Sub-surface feeders (like *Amblypharyngodon*, *Danio*, *Rasbora*, *Esomus* and *Carassius*), which are larvicidal to a considerable extent.

4. Column feeders (like *Barbus* (*Puntius*), *Ambassis*, *Colisa*, *Anabas*, *Macropodus*, *Badis* and *Therapon*) which consume larvae when they visit the surface.

5. Large-sized food fishes (like *labeo*, *catla*, *mugil*, *chela*), whose fry are helpful in the reduction of larvae.

6. Predacious food fishes (like *Wallago*, *Ophicephalus*, *Notopterus* and *Mystus*), whose fry may swallow larvae but both young and adults are very destructive to other fishes including larvicidal species.

The results of field experiments and observations conducted by the writer in Bengal, Bihar, Orissa, Madras, Cochin, Travancore and Bombay show that among the indigenous 'mosquito-fish', *Aplocheilus* species are the most efficient. *A. panchax* is known by various local names such as *panchoke*, *trichoke*, *techoke* and *dhenuchuno*, Bengal; *kan pona*, Bengal and Assam; *gunjar*, Orissa; *lal jhingra*, the United Provinces and the Punjab ; *nga-saki*, Burma ; *udda*, *nalla handaya*, Ceylon ; and *ikan kepala timah* Batavia. *A. Lineatus* is known as *poochatie* and *chuttipooschan* in Malayalam, while *A. blockii* is called *pachai mundu kanni* in Tamil. In addition other groups mentioned above may be employed as supplementary species to aid the prime agents of control, even though they are less efficient.

Procedure of control

The actual utilization of 'mosquito-fish' for control work may now be considered. The procedure has to be planned with due reference to the ecological features of the area to be treated. Thus a systematic survey of the mosquito-breeding places, including all collections of water in which the aquatic stages of mosquitoes, viz. eggs, larvae and pupae, are found, in a given locality, should first be made more or less by the malariologist's technique. From physico-chemical points of view, most of the waters in which mosquito larvae can thrive can usually sustain hardy 'mosquito-fishes'. However, as already explained, the fish method is best suited for more or less permanent waters. Too shallow and temporary water collections drying up in a few days may be treated with other methods such as oiling, paris greening, etc.

Having listed the water collections, those chosen for control with fish should be roughly mapped out, and the larval incidence in them recorded regularly. Fish can be introduced straightaway, or better still, after clearing any dense surface vegetation that may be present in the water. Removal of predacious fish that may be present is beneficial, and the 'mosquito-fish' will live and multiply in peace. The ratio of 3 fish (2 adult and 1 young) per square foot of the breeding area has been found suitable in the case of *Aplocheilus* under normal conditions. It has to be noted that the actual breeding is usually confined to a narrow strip of water adjoining the shore, surface floatage, or emergent bodies in the water. When more than one species of fish are employed, this ratio can be much less in the case of each species. In the case of water collections which last only for a season, the fish may be recovered towards the close of the season and reserved for subsequent reintroduction in the following year. Perennial waters, once stocked, may need replenishing only if the environment is in any way unfavourable for the fish to thrive and multiply, as in the presence of predacious fish and other natural enemies or adverse physico-chemical changes in the water or epidemics among the fish.

Most efficient fish

Aplocheilus panchax is an egg-laying, toothed carp found in India, Burma, Thailand, Ceylon, the Andamans and the Malay Peninsula and Archipelago. In India it is widely distributed in the north, being found to occur in Bengal, Bihar, Orissa, Assam, the Punjab, the Central Provinces, Sind, Cutch and the United Provinces, while the genus is represented in Peninsular India by *poochatie* and *chuttipooschan* on the West Coast and *pacthai munda kanni* on the East. *Aplocheilus* thrives best in clear, shallow, fresh and brackish waters of low altitudes, maintaining a very gentle flow and supporting thin-leafed vegetation. The species are easily distinguished by their pike-like shape, with a flat head and a compressed body, a wide mouth cleft with a flat, protractile upper jaw marked out by a deep

transverse fold on the snout, a conspicuous silvery spot on the top of the head and a spineless posteriorly placed dorsal fin. *A. panchax* starts breeding when about an inch and a half long, i.e. when four to five months old, and is a prolific and perennial breeder, with the spawning maxima in the monsoon months. The fairly large, rounded, highly yolk-laden eggs, provided with several oil globules and an anchoring tuft of adhesive filaments, are laid singly attached to submerged vegetation. They hatch in less than a fortnight. The larva, measuring about half a centimetre has a pigmented nape and a dark abdomen. It feeds on planktonic-micro-organisms. Metamorphosis takes about three weeks, and thereafter the fry is capable of consuming larvae of mosquitoes and other insects. The adult fish continues to subsist mainly on the larvae of mosquitoes and other insects and tiny crustaceans, while worms and minute molluscs are occasionally consumed. Vegetable matter is but rarely taken in, and even that only accidentally.

The high efficiency of the fish in control work has now been definitely established and it has been found that under suitable conditions, control by the mosquito-fish is superior to the chemical method by paris green from the point of view of low cost as well as general efficiency against all kinds of mosquitoes. Hence the proper conservation and distribution of these valuable fishes in suitable waters will be a very effective step in combating the mosquito menace.

Guinea-worm control

The guinea-worm or dragon-worm, *Dracunculus medinensis*, is one of the serious tropical scourges, the eradication of which has engaged the attention of numerous investigators. The prolonged incubation period of about a year in dracontiasis renders this disease particularly liable to spread over wide areas. In India the disease incapacitates a fair percentage of the population for the greater part of the year in various areas, especially the Konkan and other regions of the Bombay Province, Salem, Bellary and other parts of Madras, Hyderabad, the Central Provinces, Kathiawar, part of the North-West Frontier Province, and areas as far north as the foot of the Himalayas. Further, it is possible that under favourable conditions it might assume epidemic proportions wherever the transmitting host occurs. Besides man, domestic animals have been found to be affected by dracontiasis.

The only practical curative treatment is the surgical method based on the Indian '*tumri wallas*' suction process and the classical slow winding process ; but even this has its own limitations according to the stage of the disease. It can only be from the application of preventive measures that the eradication of the disease or even its diminution is to be expected. Treatment alone is not likely to effect immediate reducing of the amount of infection with worm parasites, and the control of the intermediate hosts of the parasites would be the most practicable method of eradicating them. As is well known, the myriads of minute guinea-worm larvae, discharged into water from the ulcer of a patient, enter the digestive tract of certain species of cyclops, undergo certain post-larval changes there and become capable of further development in a human host. Man gets the infection by swallowing infected cyclops along with drinking water. Hence attention has been drawn to the destruction of cyclops with a view to eradicating the disease.

Problem of control

Various measures for control have been suggested, such as displacement of step-wells by draw-wells (step-wells have been found to be a common source of infection in India, the infectivity depending primarily on the presence of cyclops in them), removal of cyclops by filtration, and treatment of the water by chemicals like lime, perchloron, copper sulphate, etc. One of the best methods of successfully combating cyclops and thereby guinea-worm on an extensive scale would, as in the case of mosquito-control, be the biological method with the help of their natural enemies, of which cyclopscivorous fishes would be the most effective.

The glassfishes have been ascertained to be of great utility in the destruction of cyclops. These fishes are small and they thrive extensively in standing and running waters in India and Burma. They are known by different local names such as *chanda*, Bengal and North-West Frontier Province ; *pee-dah*, Sind ; *lal chanda*, Ooriah ; and *sennel* or *kaka sennel*, Tamil ; *mucknee* and *ched-du-ah*, Punjabi ; *son-dah*, Assamese ; *pud-du* and *put-to-lah*, Sindhi ; *gaude-chiri*, Marathi ; *ak-kurati*, Telugu ; *buck-ra* and *pom-pi-ah*, North-West Frontier Province ; *kart-kana* and *goa-chuppi*, Ooriah. These fishes are characterized by compressed, transparent bodies, armed with

spines in the fins. They grow to a few inches only, and, though full of bones, are relished by the poorer classes, and in the salted and dried condition they are often stored in the village larder. They are noted to breed during the rains. The numerous minute eggs, 'sprayed' on to submerged vegetation, hatch in a day or two. The tiny fry cling to stationary objects for two or three days, after which they swim about actively and grow quickly, feeding on micro-organisms. The adults feed at all depths of water, subsisting mainly on cyclops. Their mouth and gill apparatus are well adapted for the filtration of such micro-fauna. Though delicate-looking, they are quite hardy and easy of transport and acclimatization. Thus they are ideal cyclopscidal fish which can be effectively employed in anti-helminth campaigns.

Water sanitation

While a moderate quantity of the proper type of aquatic vegetation is conducive to the healthy upkeep of the waters, overgrowth of rank vegetation is not only detrimental to the ecological economy, but also tends to pollute the water and to harbour numerous noxious organisms. Hence a proper check on aquatic vegetation is highly desirable. Certain carps have been observed to be useful in putting down rank vegetation in waters inhabited by them.

Another sanitary purpose served by fish is in scavenging. Offal and filth feeding is resorted to by many fishes, and they help to divest the water of organic refuse, which would otherwise accumulate, putrify and pollute the water. The mediterranean sea bream has been reported to be helpful in purifying water and when the bionomics of more of our air-breathing mud and mire fishes come to be known it is likely that some sanitary species useful for the purification of sewage and sullage pools may be discovered. In this connection it may be noted that in certain fish farms as in Dhapa in the suburbs of Calcutta, the corporation sewage is utilized for manuring the nurseries, rearing tanks and fishing lakes ; for the surface sewage is found to yield excellent nutriment for the growing fish. Even in the sewage canal proper, certain fishes like *tengra* are found to thrive.

It will be clear from the foregoing observations that apart from large-sized food fishes, the small species occurring in neglected pools and shallow waters scattered about the land, are of considerable significance, and the conservation and improvement of their fishery will constitute a valuable programme of Public Health Fish Farming.

WORLD'S RECORD BULL

ONE of the leading automobile and aircraft manufacturers in Great Britain—Sir William Rootes, K.B.E.—has just acquired Antonio III of Toadsmoor, which has taken its place in Sir William's herd on his 3,000 acre Estate at Stype, near Marlborough. This splendid animal has been well described as the world's record bull, for not only it has behind it a wonderful milk record but—and this is especially valuable in countries where the sunshine is limited—the milk possesses a particularly high butter fat content.

Antonio III of Toadsmoor (15558, born November 14, 1940) was sired by that grand bull Violet's Valentine II of Chouet (11803) out of Toadsmoor Portia (51266) and was bred by G. R. Cobb of Stroud, Glos. (brother of John Cobb, the racing motorist). Tracing back some of the famous strains of Guernsey Island breeding, Antonio III will undoubtedly prove a valuable sire to the Guernsey breed, and this is particularly important in view of the British Government's determination that high quality T. T. milk shall be nationally available. —*The English Guernsey Society, Clevedon, Wokingham.*

WARTIME PROBLEMS OF CATTLE-FEEDING

By N. C. Das Gupta

Research Officer, Cattle Feeding Research Scheme, Bharari, Jhansi[1]

STRANGE as it may seem, with the Grow More Food campaign all over the world, very few in this country have realized the importance of the bovine population and the part it can play in the present crisis. In India, with its present milk yield of 800 million maunds annually, one need hardly emphasize the immense possibilities of better production if proper care is taken in feeding the cattle. Moreover, unlike other countries, bullocks play a very important part in transport as well as cultivation since other means are scarce and sometimes unsuitable. The importance of bullock power has been further enhanced by the increase in demand for transport and cultivation. To cope with this situation it is necessary that the potential productive capacity of Indian cattle be made available to a greater extent which is possible only through proper feeding.

Requirements of cattle

Protein and energy are the chief requirements of cattle. An animal at rest requires about 0·6 lb. digestible protein and 6 therms of energy per 1,000 lb. of body-weight, the ratio being about 1:10. During hard work, such as is necessary for transport or cultivation, the requirement of energy is approximately doubled. Protein is not the normal fuel of work. The major requirement is feed rich in energy. For production of 1 lb. of milk about 0·05 lb. of digestible protein and 0·338 therms of energy are necessary in addition to that required for maintenance. On an average, the requirement of energy by cattle is about 8 to 9 times more than that of digestible protein.

India produces large quantities of oilseeds and unlike western countries, the present crisis has not much affected the availability of oilcakes. Usually these are used to supplement protein in the cattle feed. The amount of protein normally available is below the requirement for the total cattle population of this country. But the breeders, who are particular about the proper feeding of their cattle, can obtain enough oilcake for their requirements due to the restricted export these days. Oilcakes are rich in energy as well, but it is not advisable to supply all the energy requirement through cakes alone, as it will involve high protein feeding which may prove harmful. Cereals, which are the chief sources of energy, are necessary to balance the ration. Coarse fodders such as hays and straws also supply energy, but the availability is so low that it is not possible to make up the requirement by these bulky roughages, since the capacity of intake of the cattle is limited. Maize, barley, sorghum, etc. are suitable cereals for this purpose. In India, even under normal conditions the cereals are costlier than protein-rich feeds. Thus difficulties are experienced in making the balanced rations economical. To maintain a supply of sufficient cereal grains for human consumption alone these days is a problem by itself. Moreover, the abnormally high price of the cereals has rendered their use prohibitive as cattle feed. This problem can be solved either by growing more feed and fodder by the cultivation of wasteland, use of better varieties of seeds and improved methods of cultivation as encouraged by the Agricultural Departments, or by the proper utilization of the available feeding stuffs.

Molasses as a substitute for cereals

Molasses is available in large quantities as a cheap by-product of the sugar industry. It is relished by stock and when mixed with roughage, its palatable nature induces cattle to eat with less waste of stems and other coarse parts. It is one of the cheapest sources of energy and contains about 0·9 per cent digestible protein and 70·5 therms of energy per 100 lb. (Morrison). Barley and maize contain on an average 9·3 and 7·3 per cent digestible protein and 79 and 81 therms of energy per 100 lb. respectively. A mixture of small quantities of oilcakes with molasses can replace barley or maize as far as the digestible nutrient content is concerned, though the efficiency may vary to some extent.

[1] This scheme is subsidized by the Imperial Council of Agricultural Research, India.

Helpful criticisms were received from Mr F. Ware, C.I.E., F.R.C.V.S., F.N.I., I.V.S., Animal Husbandry Commissioner with the Government of India, in connection with this paper.

It has been found by experiments conducted by Hanke at Hawaii that cane molasses, when properly supplemented with protein-rich feeds, can be satisfactorily substituted for one-quarter of the concentrates usually fed to dairy cows. Thus the use of cereals as cattle feed can easily be curtailed to a large extent by feeding molasses mixed with oilcakes, and this is expected to prove profitable especially under present conditions. A mixture of 1¼ lb. rape-cake with 3 lb. of molasses is nearly equivalent to 4 lb. of barley. Similarly, a mixture of 1 lb. rape-cake and 4 lb. molasses is equivalent to 4 lb. of maize.

Concentrate mixtures consisting of (a) rape-cake 20 parts, wheat bran 20 parts, gram 20 parts and barley 40 parts or (b) rape-cake 20 parts, wheat bran 20 parts, gram 25 parts and maize 35 parts are quite suitable for dairy cows. Such mixtures can be economically substituted by a mixture containing rape-cake 40 parts, wheat bran 10 parts, molasses 40 parts and maize or barley 10 parts, where most of the costly and scarce grains have been replaced with molasses along with some increased quantity of oilcake. One pound of any of the above mixtures is necessary for the production of 2·5 lb. of milk. Hence, for a cow yielding 10 lb. of milk per day, 4 lb. of the suggested mixture containing 1·6 lb. of molasses is required in addition to that for maintenance. Adult cows can safely be fed with 2 lb. of molasses daily. It can be used either as an ingredient of the concentrate mixture or as an inducing agent for the cows to eat roughages with less waste when mixed with diluted molasses. The keeping quality of molasses depends upon the percentage of water present in it. Dilute molasses ferments easily and becomes useless as cattle feed while that with lower water content can be well preserved and fed throughout the year.

Rape-cake which has been used for computing the above mixtures can conveniently be substituted, weight for weight, by linseed-cake or *til*-cake without much variation in the nutritive value. If decorticated groundnut-cake, which is richer in protein content and lower in energy value, is used instead of rape-cake, it will be necessary to decrease the amount of the cake portion and increase the cereals for balancing the ration. But, where both groundnut-cake and coconut-oil meal are available, a mixture containing equal parts of these can easily be used in place of the same weight of rape-cake for all practical purposes. Of course, the choice of feeds depends upon their availability and the local market prices.

Utilization of by-products

As mentioned previously, the average requirement for digestible protein is about one-eighth of the total energy requirement. The oilcakes contain these nutrients in the ratio of about 1:2. Whenever oilcakes are fed to supplement protein, it is imperative that cereals like maize, barley, sorghum, oats, etc. having a wider ratio be added to the concentrate mixture to balance the ration. By-products, such as coconut-oil meal, cotton-seed, wheat bran, rice bran, pulse by-products, etc. contain digestible protein and energy in a wider ratio than the oilcakes. Therefore, if the concentrate mixture is composed mainly of these by-products, the requirement of costly cereals and grains can be minimized. Wheat bran, due to its palatability, bulky nature and mild laxative effect, is one of the most common ingredients in cattle rations ; but during the present crisis, the shortage of this important feeding stuff has made it difficult to use it economically as a cattle feed. Pulse by-products (*chunies*), obtained from the manufacture of split-pulse for human food, may also replace wheat bran with the same effect in feeding. Feeding trials conducted under the cattle feeding research scheme in the United Provinces have indicated that both *arhar chuni* and *mung chuni*, when fed on the basis of digestible protein, are superior in feeding value to linseed-cake, rape-cake and groundnut-cake. Hence, if these by-products are used liberally in preparing concentrate mixtures, they can conveniently replace both bran and a major part of cereals and grains necessary for balancing the ration. The composition of *chunies* varies considerably and it depends upon the amount of the meal made up of the germs and the broken particles of the seed.

The following concentrate mixtures consisting mainly of easily available by-products will prove quite efficient and economical during wartime.

	Mixture I	Mixture II	Mixture III
Arhar chuni	40 parts	40 parts	25 parts
Coconut-oil meal	30 „	—	20 „
Rape-cake	—	15 „	15 „
Cotton-seed	—	35 „	—
Rice bran	15 „	—	15 „
Molasses	—	—	25 „
Maize	15 „	10 „	—
	100	100	100

Arhar chuni and maize can be substituted by *mung chuni* and *jowar* respectively without appreciably affecting the feeding value of the mixtures.

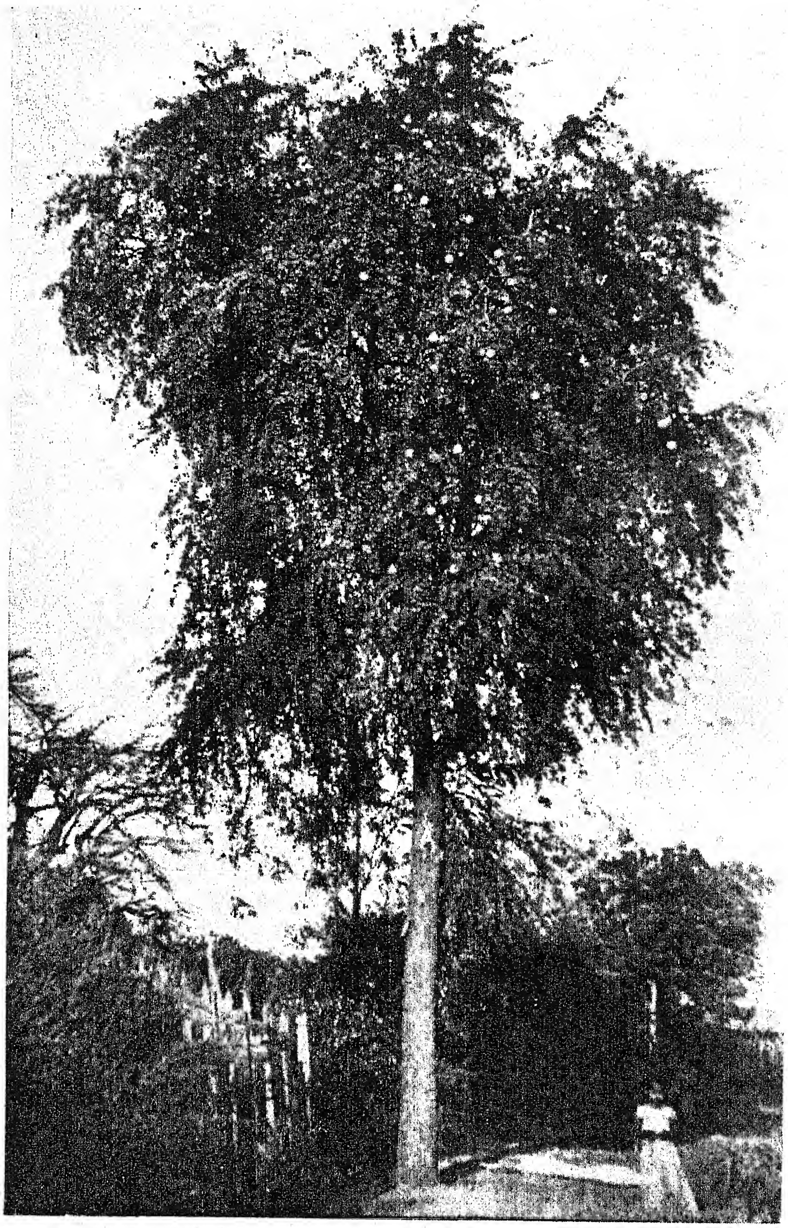
Utilization of energy from roughages

Recent work has shown that the amount of energy available from coarse fodders can be considerably increased by treatment with dilute alkali solution. Slade and co-workers have found that the digestibility of oat straw and wheat straw is enhanced when soaked in 1·25 per cent solution of caustic soda for 20 to 24 hours. By this treatment the energy available from oat straw is increased from 23·2 to 45·1 therms and that of wheat straw from 13·9 to 34·3 therms per cwt. The alkali-treated fodder when washed is readily eaten by the cattle. Though the available energy of good quality straws and hays can be enhanced, it may not be advisable to treat such stuff as there is always some loss of other nutrients by the alkali treatment. Wood cellulose can also be made equally digestible by treatment with alkali. Brierem has found that milch cows and heavy stock thrive as well on alkali-treated cellulose as on starch if it be fed in a balanced ration. This shows that the hard portion of straws of *jowar*, maize, *bajra*, etc. and of the late harvested inferior quality hays which is refused by cattle and is always a waste can be utilized and the shortage of available energy can be relieved to some extent.

In these days when caustic soda is not easily available, it is difficult to put this method into practice. Quicklime, which is available in all localities at a cheaper cost may be substituted in place of caustic soda. Czaock claims that on treatment with quicklime the energy value of straw is doubled, making it comparable to good quality hay in nutritive value.

For lime treatment, 100 lb. chopped straw is soaked in a vat of 100 gallons capacity containing a well-mixed solution of 80 gallons of water and 12 lb. of quicklime. The straw is kept well submerged for 12 hours, after which the lime water is run off. The straw is well washed and wash water allowed to drain off completely before it is fed.

It will be observed that by thus utilizing the energy content of rejected fodders, the use of cereals as cattle feed can easily be curtailed.



A typical *kavatha* tree

PLATE 4

THE WOOD APPLE

By S. S. Bhat, M.Ag.
Horticulturist to Government, Baroda State

THE *kavatha* (*Feronica elephantun*) tree grows wild in many parts of India. Being very hardy, it grows and bears fruit profusely under almost all conditions of soil and climate prevailing in the plains. It is usually found on the borders of fields, on village sites and in jungles. Like many other wild and uncultivated trees, the *kavatha* is laden with fruits by the thousand during the season. Fruits generally ripen from November to March. Ripe fruits drop from the trees, and as they have a hard shell outside, the inner pulp keeps well for some days. They are collected and sold by poor villagers at a nominal price of two to four annas per hundred. There are at least two varieties of *kavatha*, one bearing small and acidic fruits and the other larger and sweeter ones. The trees and their fruits have at present little or no economic value.

Watt[1] describes the *kavatha* tree as follows: 'A medium-sized tree, found in the sub-Himalayan forests, from the Ravi eastward; throughout the greater part of the plains of India, being more plentiful in the moister tracts of Bombay, Madras, Bengal, and Burma than in northern India. To a considerable extent cultivated as a road-side tree near villages. The leaves are aromatic and carminative, and have the odour of anise (Ainslie). The author of the *Makhzan-el-Adwiy* describes them as very astringent and as possessing the taste and odour of Tarragon. Ainslie remarks that the native practitioners of South India (in his day) prescribed the leaves 'in the indigestions and slight bowel affections of children.'

'The bark is said to be sometimes prescribed for biliousness. The ripe fruit, made into a sort of *chutney*, with oil, spices, and salt, is steemed by the natives. The fruit itself is an aromatic antiscorbutic, and in the form of a *sherbet* is sometimes given to children, alone or in combination with *bel* fruit, as a stomachic stimulant. It is supposed to increase the appetite and to possess alexipharmic properties. The pulp is reputed to be especially useful in the cases of affections of the gums and throat. It is also often applied externally as a remedy in snake-bite or employed to remove the pain caused by venomous insects. But for this purpose the powdered rind may be employed if the pulp be not procurable. The Hindus regard the unripe fruit as a useful astringent in diarrhoea and dysentery, and Muhammadan authors, for example the writer of the *Makhzan-el-Adwiy*, affirm that the fruit is cold and dry in the second degree, refreshing, astringent, cardiacal, and tonic, a useful remedy in salivation and sore throat, strengthening the gums and acting as an astringent. Elephant-apple is often used to adulterate *bel* fruit, but the two fruits should be easily enough distinguished.'

Its use as a root stock for citrus plants was attempted[2] with the result that although grafting, and budding of *santra* orange (*Citrus nobilis*, Swingle) to *kavatha* seedlings was quite successful, the resultant graft manifested unequal growths of the root stock and scion to such an extent that the former had to be rejected as incompatible with *santra* orange.

The medicinal value of the *kavatha* fruit as astringent having binding properties on the bowels is long recognized. Accordingly, various preparations of this fruit are described in Indian pharmacology. Still, the largest economic use, very limited as it is, of this fruit in this country is in making fresh daily *chutneys* and in eating fresh fruits with *gur* by the poorer classes. In Burma, this fruit is said to be commonly used for making jelly for household purposes. B. N. Singh[3] and S. Dutt also reported the use of *kavatha* for jelly.

Kavatha Jelly 1791

In an attempt made at the Fruit Preservation Laboratory, Baroda, to put this cheaply available fruit to economic use, it was noticed that the fruit is very rich in acid and pectin. The acidity of pulp varies from 7·6 per cent in raw fruits to 6·3 per cent in semi-ripe and 2·3

[1] G. Watt. *Dictionary of the economic products of India* Vol. III, p. 24—26, 1890.

[2] Cheema G. S. and Bhat S. S., 'The Dieback of citrus trees and its relation to the soils of Western India', Bombay Dept. Agri. Bulletin 155, 1928.

[3] Singh B. N. and Dutt S., 'Studies on the formation of jellies from some Indian Fruits'. *Ind. Journ. Agri. Sci.*, December, 1941 and October, 1942.

per cent in fully ripe ones. Ripe fruits contain 7·25 per cent of total sugars. The fruit thus forms an excellent raw material for jelly making. Several hundred bottles of *kavatha* jelly have been prepared and sold at the Laboratory since 1937, when the work was taken up. The cost of preparing *kavatha* jelly, as calculated on a semi-commercial scale, is about 3 annas per lb. excluding the cost of containers, and taking sugar at the prewar rate.

The fruit has a thick hard shell, inside which is a darkish-brown and acid-sweet pulp, in which a large number of small seeds are embedded. For making jelly, ripe fruits are used. The shell is broken and the pulp is boiled with water, in the proportion of 1 lb. of pulp to 3 lb. of water, for about 30 minutes. On cooling, it is strained, and to the liquid is added about its own volume of clean crystalline sugar. If about ½ oz. of lime juice is added to each pound of the extract, it is found that the quality of the jelly improves both in clearness and taste. If inferior sugar is used, the translucency of the final product is affected. To judge the quantity of sugar required to yield a good jelly, the jelmeter as well as the alcohol test were used. The thicker the extract the more the sugar required. On adding sugar and lime juice, the liquid is boiled to about 105°C, when it is removed from the fire and poured hot into sterilized containers for setting. It may be noted here that this boiling temperature will vary according to the altitude of the place of working, 105°C being suitable for sea-level. Along with temperature, therefore, the 'sheet' test mentioned by Lal Singh[1] and Girdhari Lal should be adopted for good results.

A well-made *kavatha* jelly is a clear and remarkable product of bright purple colour and firm quivering consistency. Its natural flavour is exceedingly agreeable. The jelly normally compares very favourably with that of the crab-apple. If less sugar is added or the jelly extract is thicker, a slightly hard product is obtained which approximates to black currant jelly.

In addition to jelly, *kavatha* syrup can also be prepared and used as a drink. The *chutney* of this fruit, if standardized, may also be turned into a commercial product. Work on those lines is contemplated.

Numerous *kavatha* trees exist in India, growing wild without any care or cultivation. Regular plantations of them can be raised at nominal cost in areas which lie waste. If their fruits are brought together and turned into high-grade jelly and other economic products, which they can yield, on a mass scale, what is looked upon now as a poor man's tree of no value will be converted into an asset of importance to the country.

[1] Lal Singh and Girdhari Lal, 'Jams, jellies, and marmalades from Punjab fruits'. INDIAN FARMING, Vol II., No. 4, 1941.

PRODUCTION OF COMB HONEY IN KASHMIR

By

M. R. Fotidar, M.Sc. (Calif.), *Director of Agriculture*

and

S. N. Fotidar, *Apiculturist, Srinagar, Kashmir*

At present Kashmir is probably the only place in India where the honey bee has done well in the production of comb honey and well-filled comb honey sections have been obtained there for the last two or three years. Information regarding the conditions obtaining and the methods followed at the Government Bee Farm will therefore be of some help to all interested in the development of beekeeping in India.

Comb honey produced at the Kashmir Government Bee Farm and by trained students has been regarded as being as good as that produced in foreign countries; in fact some of the sections have been regarded as good enough for the first prize in any exhibition.

Before proceeding to detail the manipulations involved a reference to the type of equipment used is necessary so that one may correctly follow the methods used in Kashmir.

We use Langstroth hives with frames having one inch top bars and short lugs. Three-ply foundations manufactured by A. Root Company is used in brood chambers and thin super foundation manufactured by the same firm is used in shallow extraction supers and sections. Sections are (2) Beeway $4\frac{1}{4}$ in. × $1\frac{7}{8}$ in. and wooden section holders with separators are used for holding sections. In this way each row of four sections is separated from others by these separators and there is no horizontal communication between these sections ; though each section communicates with the brood chamber through the beeway.

Environmental conditions

Since the Kashmir valley is situated at an altitude of over 5,000 ft. winters are very severe and there is snowfall every winter between December and March. The lowest temperature recorded during the last five years was 24°F. Brood rearing usually ceases in the colonies by about 15 November and starts again by 15 February. During this period the trees are leafless and no flora are available nor are the weather conditions favourable for the flight of bees. Under normal conditions we find four to six frames of bees in each colony about this time. The earliest evidence of bee activity comes when Pussy willow *Salix Caprea* and *Colchicum luteum* bloom (the former furnishing both nectar and pollen and the latter pollen only). These are closely followed by almond, dandelion, Brassica species, apricot, plum, pear, apple, *Rubinnia pseudo-acacia* blossoms. As a result of this sequence of blooms the colonies make rapid headway and by about the end of April we usually have colonies containing 9 to 14 frames of bees (6 to 9 frames of brood). If the honey flow outside continues for a longer time we do get surplus honey, but unfortunately this is not always the case. The plants which follow, *Berberis*, white clover and some labiates do not furnish sufficient nectar, particularly if the season is dry. We have to resort to artificial feeding from 15 May to 15 July, usually a period of severe drought. It is during this period that beekeepers in Kashmir experience great difficulty in the management of their colonies, since the latter try to abscond. Dearth of nectar is responsible for the absconding of colonies at this season ; absconding is not inherently a habit of the Indian bee. Bees do not abscond from places where there is a honey flow, or where artificial feeding is provided. Ordinarily, by the end of July we find four to six frames of bees (2 to 3 frames brood) in the zamindar colonies. During the beginning of August fresh sources of nectar become available, viz. *Cynoglossum*, Royle's Balsam and thistle, these yield nectar sufficient for the requirements of the colonies, which increase rapidly. By about 25 August our major honey flow from *Plectranthus rugosus* (known locally as *salaye kath*) commences, but our colonies are not ready to take full advantage of it, for at that time they contain only six to nine frames of bees (3 to 5 frames brood). It is therefore natural that such colonies build up at the expense of the honey flow and not for it. Special manipulations are therefore necessary for getting comb honey from these colonies.

Successful production

Before considering these it is necessary to consider the factors for successful comb honey production. These are :

(1) For the production of comb honey it is essential that the honey flow should be regular and not intermittent. The colour of incoming nectar should be white to slightly yellow. This condition can be secured only by migration of the colonies and in the valley we consequently move our bee farm to Lam (in the Tral valley) situated at an altitude of about 7,000 ft. where *Plectranthus rugosus* is the main source of honey flow of the desired quality. This plant secretes nectar copiously, particularly when slight showers of rain come at weekly intervals. It is found lower down also in the valley but the honey flow is not regular and heavy for lack of frequent showers. Besides the locality selected has the advantage of warm and windless days and cool nights which are both factors contributing to the good work done by the colonies.

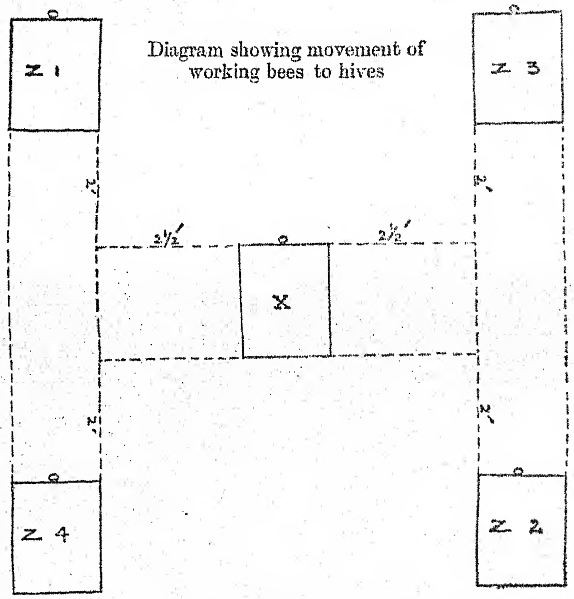


Diagram showing movement of working bees to hives

(2) Strains of bees selected for comb honey production should have prolific queens. They should not use propolis excessively. They should show regularity in comb building and cap the sections white. All these conditions fulfilled, the strain of bees used should take to work in the restricted space of sections readily.

Since Kashmir bees are not in the habit of collecting large quantities of propolis, as the Caucasians do, and since they cap their honey in white, no special selection of strains is necessary on this account. We do ordinarily select bees for comb honey production that are good gatherers, show regularity in comb building and go to work readily in sections. In practice we reserve only those colonies for comb honey production which have shown good results previously.

(3) The colonies set aside for comb honey production should not show any marked swarming tendencies, a factor which we test for at least two seasons.

(4) These colonies should be boiling with field bees at the time the honey flow starts. This is imperative if the honey flow is of short duration (e.g. *Plectranthus rugosus* in the case of which it lasts for three weeks only).

As explained above, our colonies are not ready for the comb honey harvest when the major honey flow starts. This is because strength in field bees is not sufficient to take the harvest. This deficiency could be made up by increasing the field bee population exclusively rather than by uniting two or more colonies, because in the latter union young bees also are added, resulting in swarming in the midst of the honey flow. In adding field bees we take advantage of the fact that bees loaded with nectar can gain admittance into any colony during a heavy honey flow.

Special manipulation for comb honey

Suppose a colony (X) selected for comb honey production contains nine frames of bees (six frames of brood) at the commencement of the honey flow. We rearrange the combs so that the youngest brood is on the sides of the hive away from the centre and the mature brood is in the central combs. This ensures that the brood chamber is not jammed with honey and bees are obliged to carry nectar to section supers. Then the colony, the field bees of which have to be added to (X), is slowly moved a few feet every day from its original position to the position (Z1), as shown in the accompanying diagram.

In case the colony the field bees of which have to be added to (X) is far away, it should be brought to position (Z1) slowly by the time the honey flow starts. If that is not possible

it can be brought straight away to the position (Z1) by closing its entrance with zinc gauze when all the field bees have ceased flying the previous evening. The sides of the hive should be rapped continually for about five minutes at the end of which time it should be removed to the position (Z1). Now the zinc gauze closing the entrance is removed and replaced by a glass slide which is kept inclined on the projection of the bottom board facing the exit of bees, so that the bees coming out strike against the glass slide before they can go out. Thus the bees will reorient themselves to the new location (Z1). A few bees will of course be found hovering at the old location ; but, not finding the hive there, they will go to the new location at (Z1). In this respect they excel Italians.

After the bees have been settled at the position (Z1) for 3 or 4 days the hive at (Z1) is moved at about the middle of the day to the diagonally opposite position (Z2) without any disturbance. Not finding the hive, all the field bees returning loaded with nectar at (Z1) will join the hive (X). Not only will the bees that are out foraging at the time of transfer join (X) but also those bees which go out after the hive has been placed in the position (Z2), if the transfer has been effected without any disturbance so that bees have no occasion to reorient themselves to the location (Z2) immediately. This will go on for a day or two. After three days from the date it has been moved to the position (Z2) the hive is slowly moved forward to the position (Z3) in about a week's time. The hive is allowed to remain at (Z3) for about three days and then moved to the diagonally opposite position (Z4) during the middle of the day when more of the field bees will be added to (X). These will give an excellent account in supers. In the 1940 season one such colony of good gatherers gave us two section supers, i.e. 56 sections, some weighing 18 oz. and one shallow extraction super, i.e. 30 lb. of honey. Other colonies similarly treated gave us one section super each in addition to extracted honey.

Three or four days after transfer of the colony to (Z4) position it is placed in a new location. No harvest is to be expected from this colony, but if at the end of the operations the honey flow is still continuing it can develop to the extent that it will tide over the winter of Kashmir safely, provided care has been taken to see that it is not short of stores after the fielders have been removed to the colony (X). Not only may the field bees of one colony be added to the colony set aside for comb honey production ; those of two or even more may sometimes be incorporated with it to advantage.

As soon as the honey flow commences the bees must go to work in the section supers. If they do not, they must be coaxed to go up to the sections by the use of bait sections placed in the supers. In case no bait sections are available four sections may be fitted into a shallow extraction frame and placed in the brood chamber of some colony and after the bees have started work in them in the brood chamber, these sections can be placed in section supers in the colonies set aside for comb honey production. The bees will start work in them immediately.

FODDER PRODUCTION FOR DAIRY STOCK

By

B. S. Patel, B.Ag., N.D.D., N.D.A.(Eng.), I.A.S.

Professor of Agriculture and Principal, College of Agriculture, Poona

and

M. M. Desai, B.Ag.

Manager, Agricultural College Dairy, Kirkee

THE world population of cattle is about 656 millions ; nearly a third of this, the largest number owned by any single country, is in India. The cattle population of Bombay is 97,33,659. A rough estimate of the outturn of various kinds of fodders available from crops raised either solely for fodder or as dual-purpose crops, shows that the cattle are very much underfed, averaging about 7 lb. of dry fodder per head per day.

The solution is increased production of fodder crops. Some attempts in this direction have been made at the Agricultural College Dairy, Kirkee, and the information gathered therefrom is presented in this article.

The Agricultural College Dairy maintains livestock, about 180 to 200 adult units, consisting of cows, buffaloes, young stock of either kind and sex and bullocks. The total area cropped is about 260 seasonal acres. With systematic seasonal cropping, maintenance of crop rotation followed with adequate manuring, irrigation and adherence to principles of better crop raising, it has been found possible to produce about 45,00,000 lb. of green fodder from the total area, which gives an average of 17,000 lb. of green fodder per acre.

Soil and climatic conditions

The soil formation is from trap rock. The depth of the soil varies from 1½ to 2½ ft. The layer of soil is laid over that of sub-soil which consists generally of *murum* (disintegrated rock) resting on trap rock below. The soil is light in nature and is well drained and suited for irrigation.

Average rainfall is about 27 in. distributed over a period of 45 to 47 days. A little more than 75 per cent of this is recorded from June to September.

The mean temperature varies from 63·2 to 90·80°F. The maximum goes up to 107°F. in April. The minimum, as low as 43°F, is reached in January. The monsoon mean temperature, 69·2 to 83·50°F, is favourable for crop growth.

The Dairy runs two stations, one at Kirkee for milch stock and the other at Manjri, 12 miles from Kirkee, for dry stock and young growing stock. The area of the former is about 42 acres and that of the latter about 125 acres. The soil at Manjri, though more fertile, suffers for want of sufficient humidity of the air.

Perennial crops

Guinea grass : This is a well-known perennial fodder which also does well under the shade of such trees as banyan and mango and where no other crop is likely to thrive.

Attempts were made at the Dairy to find out the maximum limit up to which the crop would yield under heavy manuring. In 1938 a plot of 21 *gunthas* ($\frac{21}{40}$ acre) was planted in June-July, after good preparatory tillage and manuring with 17 carts of fresh dung and 8 carts of farmyard manure before and after ploughing respectively. Thereafter the plot was manured from the byre washings of 70 to 80 animals.

In the first cutting in August, the crop yielded 2,826 lb. per acre. In the second cutting in September, it yielded as much as 13,120 lb. per acre. The crop yield then declined with the advent of the winter season only to go up again gradually with the setting in of the summer season.

In the second and third years, it yielded 92,921 and 1,51,605 lb. per acre in six and nine cuttings respectively. Similarly in 1940 a plot measuring 33 *gunthas* with May-June planting yielded 1,03,504 lb. of green fodder per acre as a first-year crop. The total cost of raising the crop on 21 *gunthas* was Rs. 167-10, Rs. 81-2 and Rs. 212-4-9 for the three years respectively. The higher cost in the first year was due to preparatory tillage and manurial charges and maximum cost in the third year was due to higher charges for harvesting a heavy crop for feeding it green to the cattle. In fact, Rs. 163 was spent in the third year for harvesting only.

A portion of this charge could have been avoided but for the necessity of daily harvests in small quantities to maintain an effective supply of green fodder to the dairy stock.

Facts worth noting with this crop are :

(1) Prepare the land well for planting sets 3 ft. apart, the best season for planting being the beginning of the monsoon.

(2) Manure the crop with heavy doses of organic manures and keep the fields clean of weeds.

(3) The crop yields heavily during the monsoon and gives about 8 cuttings in a year with monsoon planting. The first cutting yields the least and the second, the highest.

Lucerne : There are two varieties of this crop generally grown on this side. One is known as the Quetta variety and the other as the Persian or Ahmednagar variety. The former is grown by local cultivators in beds and is raised as an annual crop. The latter, raised on this farm, occupies the land for about $2\frac{1}{2}$ years.

The plot to be grown with this crop is first of all manured with well-rotted farmyard manure at the rate of 10 to 15 carts per acre. This is then sown with sunn (*Crotalarea juncea*) in the beginning of the monsoon season. The plants begin to flower after two months, when the crop is ploughed in for green manure. After the green matter has rotted well, the field is prepared for receiving the seed. Straight ridges and furrows $3\frac{1}{2}$ ft. apart are made by a ridging implement and seeds mixed with loose earth, preferably from a field previously grown under lucerne, is broadcast in the furrows in October-November, the width of the furrow sown being 9 to 12 in., seed-rate 15 to 20 lb. per acre, including subsequent filling in of gaps. Light covering with a hand sickle is done and a light watering given. A second watering is to be given after three days, to be followed by regular waterings at intervals of 8 to 10 days.

The crop is ready for the first harvest six to seven weeks after sowing. This is to be made out from the fact that the plants at this stage would begin to throw out new roots and shoots which could be easily seen. A second cutting will be available about a month later and all subsequent cuttings can be had at intervals of about three weeks when the plants are in flower.

When roots are sufficiently developed and strong enough to receive water from the adjoining furrow, earthing up is to be done. The beginning of the monsoon has been found to be the best for this operation.

A top-dressing with groundnut-cake at the rate of 300 lb. per acre equivalent to 20 to 25 lb. of nitrogen is given just prior to or soon after earthing up. Two or three similar top-dressings with groundnut-cake may be resorted to at an interval of three or four months. In the absence of groundnut-cake, well-rotted farmyard manure or preferably poudrette at the rate of 5 cartloads per acre per top-dressing may be used. Manure is applied before irrigation into the furrows and well mixed by means of subsequent interculturing.

Weeds injure the crop and therefore it should be kept scrupulously clean of weeds. Weeding may be carried out during harvest. The crop is also to be intercultured after every cutting.

The crop yields the maximum during the second year of its growth, the average per acre going up to 93,995 lb. at the Kirkee site. As a third year crop, the average yield goes to about 65,000 lb. with about 150 lb. of seed. The total yield for $2\frac{1}{2}$ years comes to 1,72,900 lb. per acre on an average of 10 years with about 148 lb. of seed that is obtainable during the final year of its stand. The total average cost of cultivation per acre for the three years comes to about Rs. 450. The seeds could be easily sold at Re. 1 per lb. (The selling rate at the dairy is Re. 1-4 per lb.) The cost therefore of 100 lb. of green fodder after deducting the value of seeds would be about 2 as. 9 pies.

The crop should be allowed to go to seed and no cutting should be taken from the month of March onwards when the seeds are being formed, and it is desirable to stop further irrigation to avoid subsequent vegetative growth. Seeds are harvested by hand-picking of the pods. The number of hand-pickings will be about three. A better method now adopted is harvesting the ripened pod-bearing branches with sickles and thus economize in the cost under harvest.

The method of cultivation detailed above keeps the field clean of weeds, aerates the soil well, and permits of residual manurial effects for the crop taken after lucerne. Such a crop after lucerne yields heavily. The average acre-yield in green fodder of maize and *chavali* (cowpea) mixture, which generally follows lucerne comes to 29,029 lb. as against 19,732 lb. of the same crop raised ordinarily during the monsoon.

During 1941-42 a plot of four acres previously grown with lucerne was put under *nilwa* fodder *jowar* which is a good local *kharif* (monsoon) variety. The monsoon of the year did not fare

well and yields below normal were generally expected from the crops. Yet this plot sown with *nilwa* after lucerne appeared to be in vigour from the start and yielded 30,766 lb. green fodder per acre as against an average of 16,468 lb. of the whole crop of *nilwa* during the year.

Annual or seasonal crops

Maize and *chavali* are grown both as a *kharif* (monsoon) crop and a hot-weather crop. Maize is a surface feeder and requires a fairly good dose of organic manure. It is highly susceptible to excessive moisture and proves a failure under waterlogged conditions. Generally it has been found to yield much better as *kharif* crop than as a hot-weather crop. It has been found to do especially well, if raised after lucerne in rotation, the average yield being about 29,000 lb. per acre as stated before against the ordinary average of about 17,000 lb. The maximum yield has once gone to about 40,000 lb. green matter per acre, the plot having been manured with washings from the byre. The maximum yield as a hot-weather crop, if sown late in the season and subsequently supported by monsoon showers, has gone up to 33,488 lb. of green fodder per acre. The seed-rate used is 50 lb. of maize and 7 lb. of *chavali* seed. The peculiarity of this mixture is that whenever the maize plants fail to thrive, *chavali* plants may be found in preponderance. Some of the *chavali* plants will be found trailing on the maize plants. The fodder obtainable is highly nutritious and palatable as it consists of a mixture of a legume and a cereal. Until very recently the crop was sown in lines one foot apart. During the *kharif* of 1940-41 it was decided to sow the seeds with wider distance and sowings in lines 2 ft. apart were generally resorted to with the result that the wider sowings yielded at the rate of about 5,000 lb. more of green matter per acre. It is rather premature to say anything definite in the matter until further observations are made. However, these results go to show the possible indications.

Wider sowings would permit of interculturing implements being used as often as necessary which goes a good way in keeping the field clean of weeds and thus indirectly helping crop growth. One thing, however, that may be said against the method is that the stems of the plants grow thicker and much wastage would accrue in actual cattle feeding practice. This, however, would be more than compensated for by the higher returns.

Maize is a crop which though highly palatable to the stock, should much better be fed with some caution. Just prior to the milk stage, it contains moisture up to 70 per cent. If fed at this stage, the stock are very likely to suffer from impaction troubles. In the milk stage and subsequent stage also it is rather constipative and as its consumption is likely to go high with individuals on account of its palatability, there is always the risk of some of the individuals suffering from impaction troubles. On the whole if fed with care this is a fodder which supresses all other fodders available from cereals, excepting that of oats and peas, for milk production. The cost of production of 100 lb. of green fodder comes to about 5 annas, about 25 cer cent of which is for preparatory tillage and 25 per cent is for manuring charges.

Oats and peas: This is a cold-loving crop and can best be grown under winter conditions. It may be sown from the second fortnight of October but yields particularly well if sown late in the season when it is pretty cold. The crop has to be irrigated every 10 days after sowing. If days are cold enough and the crop is in good vigour, it would be found beneficial to miss an irrigation at times. The crop will not thrive if sown late in January as it has then to go through warmer days.

A good crop will yield as much as 25,000 lb. of green per acre or even more. It can be fed at any stage. If cut just at the time of flowering, it yields a ratoon crop. It can also be turned into highly nutritious hay. The average yield at Kirkee, where cowdung at an average rate of 17 cartloads was applied, has been about 17,000 lb. of green. The cost of production was about Rs. 70. Cost of production of 100 lb. of green therefore works out to 6 annas and 7 pies. A half of this cost is for preparatory tillage and manuring.

This is a crop which perhaps surpasses in its high feeding value all other fodders obtainable from cereals. Its nutritive ratio, when in full milk, is as narrow as 1 : 5. When the milch stock is fed with this the milk yield goes up and thus permits of a fair reduction in their concentrate allowance.

Nilwa is a *jowar* fodder variety specially grown in the Poona district as a *kharif* crop.

It is a fairly good crop for feeding cattle, when in milk. It can also be made into dry fodder called *kadbi* and stored as such for feeding stock. The crop is sown in rows one foot apart. The seed-rate is about 60 to 65 lb. of

jowar seed and 6 to 8 lb. of *chavali* seed. The thick and close sowing yields a crop which is thin in stalks and when fed gives less refuse in the stall. However, *chavali* does not thrive in *jowar*.

At the Kirkee site with about 16 cartloads of manure per acre in the form of fresh cowdung, the average acre-yield went up to 19,951 lb. of green fodder. At the *Manjri* site where there are less manurial facilities, manure at 2 to 3 cartloads of farmyard manure or poudrette was applied with the result that the average acre yield went up to 14,900 lb. green. The average cost of production at Kirkee, comes to 4 annas 2 pies per 100 lb. of green fodder.

Shalu : There are several varieties of semi-*rabi jowars* grown in the Deccan, sowing being done in September. The variety generally grown on this dairy farm is *kalbondi*. *Shalu* yields fodder of the very best kind among the various *jowar* varieties in cultivation in the Deccan.

It can be raised solely for fodder purposes when it will not be allowed to go to maturity or seed formation. Harvesting is done by up-rooting the plants. It is also used as a dual-purpose variety for both grain and fodder. The grain is the staple food of parts of the Deccan.

At the Kirkee site, with 13 cartloads of fresh cowdung per acre, the average acre-yield has gone to 12,499 lb. of green fodder at a cost of Rs. 50, giving 6 annas 5 pies for 100 lb. of green fodder.

Green lucerne for milch cattle

The college dairy keeps 41 milch cows and 79 milch buffaloes for milk production and for breeding and rearing improved stock. These cattle are fed on green lucerne and other seasonal green feeds or silage and dry fodder throughout the year. In April, May and June, the fodder fed per animal per day comes to about 15 lb. of green lucerne, 25 lb. of silage of maize and *chavali* and 9 lbs. of *kadbi*. In July, August and September, the fodder comes to 15 lb. of green lucerne, 25 lb. of green maize and *chavali* mixture and 9 lb. of *kadbi*. In October, November and December, the fodder consists of 15 lb. of green lucerne, 13 lb. of *nilwa jowar* green fodder, 12 lb. of grasses and 9 lb. of *kadbi*. In January, February and March the fodder consists of 15 lb. of green lucerne, 26 lb. of green oats and peas mixture, 10 lb. of maize and *chavali* silage and 10 lb. of green *shalu* or *rabi jowar* fodder. Guinea grass is also fed to adult as well as young stock according to its availability in part replacement of other green fodders. Such feeding has been going on for more than 10 years and no deleterious effect of feeding green lucerne or guinea grass has been noticed so far. On the contrary the milk yield is well maintained.

Constant supply of green fodder

The college dairy tries to provide the bulk of the fodder as green fodder throughout the year by growing a fairly large area under perennial crops like lucerne and by making provision for silage when the green fodder is not available from the seasonal crops.

The dairy has about 155 acres under cultivation but some area is under perennial crops and some is cropped twice. As a rule each crop is grown for obtaining the highest yield possible by growing it in the most suitable season and under very good conditions of soil, cultivation and manuring to get the maximum yield. Lucerne helps to give good green fodder throughout the year and also forms a good rotation crop for two or three crops after it. Maize and *chavali* mixture is the best in the monsoon, so is *nilwa jowar*. Oats and peas do best in winter. In dry land, *nilwa*, maize, *chavali* or *bajra* are grown in the *kharif* season and if there is good late rain *rabi jowar* or gram is taken in winter.

There are two general rotations followed on the dairy. Lucerne is sown in October after green manuring with sunn and is grown for 28 months for fodder and for four months of hot season for seed. It is then followed by maize and *chavali* mixture in the monsoon to be followed by oats and peas in winter. In the next monsoon *nilwa* and *chavali* mixture is taken, to be followed by a second crop of oats and peas or *shalu jowar* for fodder.

The dry land grows only one crop a year in the monsoon when it receives an occasional irrigation if need be. The crops grown on dry land are maize and *chavali* mixture to be rotated with *nilwa* and *chavali* or *bajra* and *mataki* mixture. The surplus monsoon crops of maize or *nilwa* are made into silage to provide for green fodder for the summer and winter months when there is shortage of green fodder.

About 23 acres are grown under lucerne, 23 acres under oats and peas, 46 acres under monsoon maize and *chavali* and 10 acres under summer crop of maize and *chavali*, 92 acres under *nilwa* or *bajra* mixture during the monsoon and 20 acres under *rabi jowar* or *shalu*. The total fodder produced is about 45 lakh lb. green, out of which 6 lakh lb. of fodder—mostly maize mixture—are turned into silage, 12 lakh lb. are dried into *kadvi* (dried *jowar* fodder) or oat hay and 27 lakh lb. of green fodder of all kinds is cut for feeding cattle.

HOUSEHOLD INSECT PESTS AND THEIR CONTROL[1]—V

By Mohan Singh, M.Sc.

Assistant to the Imperial Entomologist, Imperial Agricultural Research Institute, New Delhi

CLOTHES MOTHS

CLOTHES and house moths are some of the smallest and oldest known pests. They cause damage in the larval stage of their life because the latter possess biting mouth parts whereas the adult moths commonly suck juices, etc.

Tinea pellionella Linneus, *Tineola bisselliella* Hummel, *Trichophaga abruptella* Wollaston, and *Borkhausenia pseudospretella* Stainton are the species which commonly occur in India. They are all cosmopolitan household pests recorded from various parts of the world. They are nocturnal in habits, and are attracted to lights in the house at night. Movement in these moths is not always by means of wings, especially in females which when slightly disturbed tend to run into cracks and crevices and creases of clothes without taking to their wings. Their purpose in life is to lay eggs which develop into larvae, the latter causing damage when in search of food.

TINEA PELLIONELLA Linneus

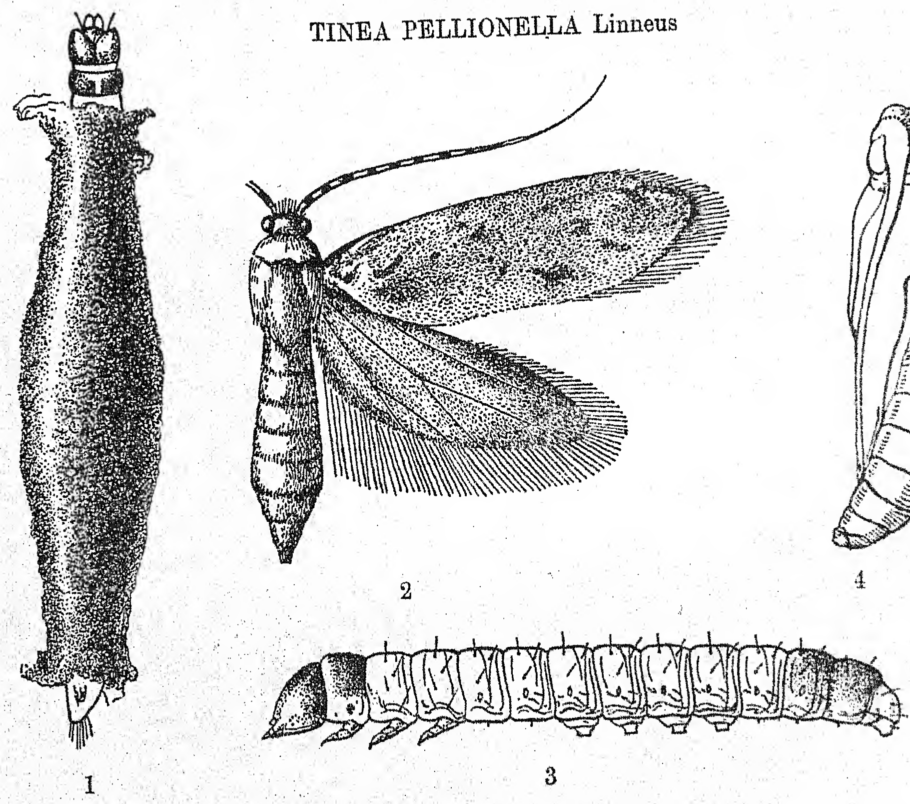


Fig. 1. Larva in case ×9
Fig. 2. Moth ×10
Fig. 3. Larva without the case with its head protruding out (as seen from above) ×3
Fig. 4. Pupa (naked) ×12

[1] Part I appeared in Indian Farming, Vol. II, No. 5, p. 238;
Part II in Vol. IV, No. 5, p. 247;
Part III in Vol. IV, No. 6, p. 285 and
Part IV in Vol. IV, No. 12, p. 608.

Tinea pellionella Linneus

It is popularly known as the 'case bearing moth' because in the caterpillar stage it lives inside a flattened silken case throughout its life (fig. 1). The moth is greyish-yellow or buff in colour with inconspicuous dark spots on fore-wings; hind wings are silky and whitish (fig. 2).

The caterpillar feeds on furs, feathers, woollens and fabrics manufactured from them, carpets, rugs, stuffed birds, clothes, stuffings and covering of upholstered furniture. It is also known to feed on glue or paste used for fixing wall papers, etc. Woollen thready or fluffy material or hairs, etc., which somehow remain lodged in floor cracks and other concealed places provide constant food and shelter for them. Damage to *Aconitium* roots, Cayenne pepper, Indian hemp (*Cannabis sativa*), black mustard seeds, ginger, linseed, almonds, saffron, poppy capsules is also on record in some countries.

Life-history: The life-cycle of this moth, like that of moths in general, consists of four distinct stages, viz. egg, larva or caterpillar, pupa or chrysalis and the adult moth itself. The time taken for the complete development is generally determined by several factors such as temperature, suitable food, humidity, etc.

Individuals pair shortly after becoming moths. The female lays eggs singly or in groups of as many as 25, either loosely upon or between folds of fabrics, at bases of hairs in furs and skins. The eggs hatch in about a week's time at ordinary temperature. In hot weather they take less than a week, whereas in winter they may take as long as three weeks.

The newly hatched caterpillar is whitish in colour. It immediately starts making a closely woven case lined with silk which the caterpillar carries about as it moves, with its head and legs protruding (fig. 1). When disturbed it retracts its legs completely within the case. It enlarges its case in length and circumference as it grows. The case usually attains a length of $\frac{1}{2}$ in. and is covered with tiny pieces of the material on which the caterpillar feeds. The full-grown caterpillar (fig. 3) is dirty-white in colour, with the body sparsely covered with fine whitish hairs. Sometimes the larva becomes quiescent inside the case by closing both its ends.

The larva pupates within the case. The pupal stage may last for a week or so in summer and about a month in winter.

Tineola bisselliella Hummel

It is popularly known as the 'clothes moth' 'webbing clothes moth', 'naked clothes moth', etc. The moth is uniformly pale in colour with unspotted wings. Its size is variable depending on food available during its larval stage.

The habits of, and nature of damage by the caterpillar are almost similar to those of *Tinea pellionella*. But it also feeds on raw, untreated skins, sometimes the dead of its own kind, including dry insects preserved in boxes.

Life-history: In general features the life-history of this species is similar to that of the preceding one. The average number of eggs laid by a female is 30 to 70 either singly or loosely, in batches hatching in about 10 days.

White, cylindrical, newly hatched caterpillars can be seen crawling on fabrics, etc. on which they immediately start feeding, acquiring the colour of the fabrics as they grow. Usually, but not always, the caterpillar spins a thin loosely woven silken tube often 10 to 15 times longer than its own length with tiny pieces of its food material. The caterpillar lives within this tube for varying periods of time feeding at either end of the tube. At times it may leave the tube for a new feeding place or it may continue to live in the same tube slowly adding to its length. It casts its larval skin several times (up to 17 times) depending upon the duration of the larval stage and on the type of food available. It may take four years to reach the full-grown stage as it often stops feeding and becomes inactive, resuming activity and feeding only when disturbed. The full-grown caterpillar is $\frac{3}{8}$ in. long, white in colour, with an ocheraceous-tawny head, with the body sparsely covered with fine whitish hairs.

The caterpillar pupates inside a dense silken cocoon formed of fibres from its food-material, which so harmonizes with the colour of the cocoon that it is often difficult to detect its presence. The pupal stage lasts for about a fortnight or so.

1741

Trichophaga abruptella Wollaston

It is popularly known as the 'tapestry moth' or 'white-tip clothes moth'. It is not so common in dwellings as the two foregoing species. It is usually found in neglected out-buildings and is comparatively a large moth with whitish-yellow wings.

Caterpillars generally feed on coarse and heavier fabrics and are usually found in carpets, heavy blankets, tapestries, feltings, furs, skins, etc. When attacking furs they live next to the skin hidden among the hairs on which they feed. The attacked hairs do not fall all at once, as their cut bases are bound up in a greyish silken webbing which the caterpillars usually exude and in which they live with their frass sticking to the webbing. At the slightest pull the hairs come off in large tufts along with the webbing, leaving the skin quite naked. Caterpillars usually construct burrows or galleries lined with silk throughout the infested material, thus spoiling more material than they actually eat away.

Life-history: The female moth usually lays 60 to 100 eggs. On hatching, the caterpillars burrow into the material they live and feed on. Usually they make no cases but sometimes they bind together their feeding galleries after the manner of the webbing clothes moth and sometimes carrying them about as is the case with the case bearing moth. The full-grown caterpillar is about $\frac{2}{5}$ in. long, cylindrical, yellowish dirty-white in colour and with soft and transparent skin.

Borkhausenia pseudospretella Stainton

It is popularly known as the 'brown-house moth' or 'false clothes moth'. It is a serious pest as its caterpillars are omnivorous feeders causing damage to several substances, besides carpets and woollen clothing, such as seed, flour, bindings of books, corks, etc. This is most likely to be found in factories manufacturing upholstered furniture, cushions, beddings, pillows, etc.

The full-grown caterpillar is $\frac{3}{4}$ in. long, shining-white in colour, sparsely clothed with fine yellowish hairs. It makes a dense silken cocoon from its food material in which it pupates. Larval and pupal stages vary large with temperature.

Control methods

Household fabrics, furniture or wearing apparel in constant use and articles frequently brushed seldom get infested with 'clothes moths'. Beating and brushing all articles containing any wool in their texture before putting them away in trunks, etc. will sometimes remove or kill the infesting eggs and larvae. Dry cleaning of clothes with petrol, washing them in neutral solution of laundry soap in water and dipping clothes not likely to be injured in hot water heated up to about 104°F for about 10 seconds are useful methods for killing larvae and eggs, but as pointed out in the case of the carpet beetle[1] these methods cannot prevent reinfestation.

Once freed from infestation, clothes should be protected by wrapping them in stiff paper devoid of any holes or tears with all edges properly tucked in or better sealed. Caterpillars of the 'clothes moths' as also the grubs of the carpet beetles, cannot eat through paper to gain access to clothes, etc, inside. In order to ensure further protection naphthalene flakes, paradichlorobenzene, or camphor should be used as recommended in the case of the carpet beetles. Any one of these substances should be placed in creases and folds of clothes which should then be wrapped in thick paper. Two to three pounds of paradichlorobenzene crystals crushed and spread freely over the infested furniture will also help to kill caterpillars there by its fumes.

Pyrethrum powder, if fresh, is reported to kill the caterpillars when thoroughly dusted over the infested clothes and placed in tight containers wrapped well in papers. As pointed out in the case of the cockroach,[2] pyrethrum loses its insecticidal value rapidly both from exposure and with age. Such insecticide, therefore, cannot be relied upon.

Cold storage is known to afford protection against 'clothes moths' but there is no commercial concern at present in India which can undertake such work.

In order to protect stuffed birds and mammals and mounted heads, etc. from the attack of these moths they be should well sprayed with petrol from time to time, ensuring as far as possible that the liquid penetrates right down to the skin.

Fumigation with hydrocyanic acid gas, carbon bisulphide, sulphur, and carbon tetrachloride (given in order of their efficacy) as described in the case of carpet beetles will be effective in completely freeing infested upholstered furniture, carpets, rugs, fabrics and clothing, from the pest. In fact, they will be useful in the case of any infested material.

Three parts (by volume) of ethylene dichloride to one part (by volume) of carbon tetrachloride produce a mixture which turns into gas slowly at ordinary temperatures. The gas is known to kill all stages of 'clothes moth' when used at the rate of 14 lb. per 1,000 cubic feet of space in airtight rooms, trunks, cabinets, etc. The gas is heavier than air, non-explosive and non-inflammable and in low concentrations not dangerous to human life. It must, however, be used under expert supervision.

[1] INDIAN FARMING, Vol. IV, No. 12, p. 608.
[2] INDIAN FARMING, Vol. II, No. 5, p. 238, May 1941.

What the Scientists are doing

CONTAGIOUS PNEUMONIA OF GOATS

CONTAGIOUS pleuropneumonia of goats, one of the major diseases in India, is of particular importance at the moment in view of the necessity, created by war conditions, of husbanding all available sources of food. The army demand for the supply of live goats to Indian troops, particularly those in forward areas, has been impeded, and in some cases frustrated, by the increasing incidence of this disease which is not, incidentally, a disease new to India. For many years, contagious pleuropneumonia of goats has been responsible for an annual toll running into lakhs of rupees. The rapidly mounting incidence of the disease and its spread throughout India is a matter for grave concern. During 1942-43, entire areas were completely denuded of their goat population. Consequently, the recognition of the disease by the owners of herds prompts them to dispose of their goats as speedily as possible. In this way, the disease has become widespread and it is now doubtful whether any province remains unaffected.

Outbreaks of pneumonia in goats have been variously described as being due to micro-organisms or to lung worms. Whilst occasional outbreaks of pneumonia due to such causes have been reported during the last decade or so, it seems likely that they are of minor significance in comparison with the now well-known epizootic pleuropneumonia of goats. Severe outbreak of goat-pox may also be attended on occasion by a form of pneumonia which is considered due to the goat-pox virus. It has similarly been stated that pneumonia is the chief, and sometimes the only visible, lesion in goats affected with rinderpest. Whatever the grounds for this assertion, the fact remains that the rinderpest virus has never been isolated, in our experience, from field outbreaks of pneumonia in goats.

It now seems likely that the form of epizootic pleuropneumonia of goats first described in Madras by Longley in 1939 is that most commonly encountered in the field, and that all other forms of pneumonia in goats are of relative infrequency and unimportance. Research conducted at the Imperial Veterinary Research Institute confirms the work of Longley as regards the cause of the disease. The causal organism has now been isolated and its relationship with the similar organism of contagious pleuropneumonia of cattle has been established. The typical disease can be invariably produced in susceptible goats either by insufflation or by subcutaneous inoculation with pure cultures of this organism. Methods of field diagnosis have been simplified and perfected and centres of infection in India mapped out. The knowledge so gained can now be readily utilized by all field workers to establish a prompt diagnosis and to help in the work of assessing the field incidence with accuracy. It is already known, as the result of these methods applied in the field, that epizootic pleuropneumonia of the goat exists in the provinces of Madras, Bombay, Sind, Assam and in the Central, United and North-West Frontier Provinces, as well as in adjoining tribal territory.

Experiments in progress at the Institute indicate the possibility that immunity in this disease will follow the lines successfully established in the control of contagious bovine pleuropneumonia by the use of a vaccine. Pending the discovery of such a vaccine, recourse must be made to those direct methods of control which are applicable in all rapidly spreading, contagious diseases. The 'stamping out' policy is the one that must be pursued once the disease makes its appearance in a herd. All obviously affected animals must be destroyed and the carcases cremated, whilst the remainder of the herd must be moved to clean ground with fresh attendants, distributed widely in small batches of not more than 15 to 20 goats and examined frequently for signs of illness. But it must be clearly understood that vaccination will not compensate for failure to observe these precautions. It is known, fortunately, that some diseases caused by organisms of the pleuropneumonia group are amenable to treatment. Experiments on chemotherapy are also proceeding at the Institute.

EFFECT OF HEAT ON MILK

HEATING milk is practised by the consumer in various forms in India not only for prolonging its life but also as a safeguard against milk-borne diseases. The most

common practice is to bring the milk to first boil and then keep it simmering over extended periods. In some places milk is strirred just before and during simmering to prevent frothing. Sometimes a few drops of water are also added to break the froth and heating continued further, the former step being repeated twice or thrice.

In a systematic investigation carried out at the Imperial Dairy Research Institute, Bangalore, the changes that occur in the chemical composition of milk when it is subjected to some of the common methods of heating, described above, have been investigated. When milk is heated to first boil in a closed vessel there is a decrease in its volume up to 6 per cent. When correction is made for the loss of moisture, milk is found to lose about 5 per cent of its important constituents.

When milk is allowed to simmer for 10 minutes after boiling, the effects are similar to those obtained with the first boil but the loss of moisture and other constituents is higher amounting in most cases to about 8 per cent.

Pasteurisation (Holding method) causes very little change in the chemical composition of the milk. However, this process is applicable only under commercial conditions.

The loss that occurs in the constituents of milk by adopting the common household methods of boiling is really serious but unless the hygienic quality of our raw market milk is considerably improved there is no other alternative for the householder but to resort to these methods.

HOW AGRICULTURE FUNCTIONS IN U.K.

THE changing of agricultural Britain from a mainly grazing to a mainly arable country in order to save vital shipping space, and at the same time maintain the health of the people, has enabled the United Kingdom to usher in the fifth year of the war with the biggest crops ever harvested in that country. One of the factors of this great agricultural advance, states a recently issued official report, has been the flexibility of the administration, which is based on the direct policy of maintaining contact between the Minister of Agriculture and each individual farmer, so that the national production plan can be properly allocated throughout all farms in the country and the output of each farmer directly linked to it.

Here is how the system works. Under the Minister of Agriculture, who is assisted by regional liaison officers, there are: (1) War Agricultural Executive Committees, the members of which include representatives of land owners, farmers and farmworkers. They are unpaid and function on a democratic basis, their powers including that of being able to compel any farmer falling below specific standards either to improve his farm or surrender it. (2) District Committees, appointed by the Executive Committees to represent them in areas within the country. (3) Parish Representatives who maintain direct contact with individual farmers. Meanwhile the Minister of Agriculture consults regularly with the National Farmers' Union, the Workers' Union, and the Central Land Owners' Association.

The various policies which each reach the individual farmer include the encouragement of ploughing up the grassland areas ; the live-stock and feeds policy which gives priority to the milking herds ; the efficiency policy which co-ordinates all scientific research and its practical application to the individual farmer ; the mechanization policy, by which incidentally about two thousand farmers who had not the means were supplied with the necessary machinery by the War Agricultural Committees, in whose discretion the hiring out of machinery lies ; the labour policy, under which a permanent agricultural labour force of about 370,000 farmers and 700,000 men and women farm workers has been established, assisted at harvest time by thousands of organized voluntary help ; the reclamation policy ; the Fertilizer Distribution ; and the voluntary efforts of the non-farming population. Allotment holders (one and three-quarter millions of them) and private gardens (five million) in 1942 produced about £15,000,000 sterling of fruit and vegetables.—*Department of Agriculture, Canada.*

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Service in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. (a) Where can I get the apparatus for the new test of fat percentage in milk devised by the Imperial Dairy Institute ?

(b) I handle a small quantity of milk and it is difficult for me to use a drum cooler. How can I keep milk good at least for 6 hours? Milking is done from 3 to 4, transit 4 to 5 and distribution 5.30 to 7.30.

A. (a) You may obtain Ha-Ha outfit from Messrs Gopal & Co., Madras. Before the present war, the price of this apparatus was about Rs. 40 and supplies were obtained from Germany. It is not known whether Messrs Gopal & Co. have a stock of these now, and if so, what do they charge. Even if an apparatus is obtainable, the future difficulty would be regarding the special Ha-Ha butyrometers and Ha-Ha solution. The latter, however, could be solved by using the substitute, which has been evolved by the Imperial Dairy Institute. If you wish to procure an apparatus and are able to get one, and in case you need a substitute of the testing solution, you may refer the matter to the Imperial Dairy Institute, and the information will then be supplied to you. In case you are not able to get a Ha-Ha outfit the other alternative would be to try and obtain the Gerber apparatus.

(b) Under the circumstances the only thing to do is to employ strict hygiene in all the work. The milking pails should be of the sanitary type, as well as the strains and churns. They should all be thoroughly cleaned and thoroughly sterilized in boiling water, and allowed to dry in a clean and cool place. Milking must be done with the greatest possible care and milk should be handled in such a way that subsequent contamination is reduced to a minimum. During the distribution the milk must be kept away from sun and dust. Delivery tap churns should be employed to prevent exposure of the milk to contamination and all delivery must be expeditiously done. It would be an advantage to cool the milk with cold water if available by immersing cans of milk in a tank of cold water and then insulating the cans with a gunny pad. The pad should be kept wet with cold water throughout its journey on the rounds. Strictest attention must be paid to cleanliness throughout this process.

Q. Please recommend a book on sericulture. I want to start a cottage industry.

A. You may read :

Instructions for rearing Mulberry Silk-worms. Pusa Bulletin No. 39 (Price Re. 1).

Report of the Indian Tariff Board on the Sericultural Industry of India (Price Rs. 2).

The Silk Industry of Japan by C. C. Ghosh (Price Rs. 4).

All the above are published by the Manager of Publications, Civil Lines, Delhi.

What's doing in All-India

MADRAS

By Sri T. Vinayaka Mudaliar, G.M.V.C.
Superintendent, Livestock Research Station, Hosur

HOSUR taluka is the northern-most taluka of Salem district, Madras. It gains its importance from its nearness to Bangalore, a greater part of it possessing the same charming and salubrious climate as Bangalore. This taluka is a continuation of Mysore plateau and is about 3,000 feet above mean sea level. The temperature here rarely exceeds 90°F even in the hottest months, while the minimum temperature sinks to less than 60°F in the months of December and January. The taluka is favoured by both the south-west and north-east monsoons. The soil is chiefly red and black is exceptionally rare. There are numerous tanks, big and small in the taluka which are the main sources of water supply both for men and cattle. The chief crop of the taluka is *ragi* grown on dry conditions and there is a certain amount of wet cultivation also in the neighbourhood of tanks which are purely rain-fed. There are pasture areas in the taluka giving fairly good grazing for cattle. The southern portion of the taluka is hilly and cattle are sent for grazing in the reserve forests.

Facilities for cattle breeding

This taluka possesses natural facilities for breeding and rearing cattle. According to the latest figures available the cattle population of the taluka is 1,75,310 and that of the buffaloes 14,019. The breeds of cattle in the taluka are: (1) Hallikar, (2) Alambadi and (3) Non-descript. Though Hallikar breed is of a minor proportion to the total cattle population, its proportion in this taluka is large and its purity can be seen only in this part of the province affording much scope for further improvement of the breed.

It is in this taluka that the premier Livestock Research Station, of the Madras Government is situated, under ideal farm conditions and the *ryots* of the taluka to whom scientific cattle-breeding was unknown have commenced to learn the art by contact with this farm and some of the cattle owners are now good cattle breeders also. The location of the Livestock Research Station has made the taluka the centre of animal husbandry activities in the province.

Government have introduced various schemes for cattle improvement in the province and the following three schemes are in operation in this taluka: (1) Premium Scheme, (2) Government of India Grant Scheme, and (3) Anchetty Scheme. The last one is unique in itself and is worth being copied by those interested in cattle-breeding. The scheme is worked on a cooperative basis by a society of cattle owners of the village Anchetty in this taluka under the guidance and active support of the revenue, forest and other rural development departments of Government. At present there are six approved breeding bulls under the management of this society and they are doing very well.

The most suitable breed for this locality is the Hallikar breed and efforts are being made to improve in this taluka only this breed. There are various breeding bulls under the premium scheme in the taluka. Under the Government of India Grant Scheme, there are ten Hallikar bulls, two Murrah buffalo bulls and four Bikanir rams. This scheme is very popular in the taluka and there is much demand for livestock under the scheme. The working of these schemes in this taluka has been a splendid success and the demand for pure Hallikar breeding bulls is greater than their availability.

Sheep-breeding at Hosur

Madras tops the list of provinces with regard to the stock of sheep, the number being 121·9 lakhs as per census of 1935. But with regard to the quantity of wool production it is the fourth and regarding quality of wool it is the last. This is mainly due to the industry being in the hands of illiterate people who have not understood the importance of wool industry.

Sheep are mostly maintained in this province for meat and manurial purposes only, except in certain parts of the Ceded Districts where some attention is paid to wool industry. In certain districts such as the Nilgiris, Nellore and Madras where some woolly sheep are to be found, they are not regularly clipped and the wool that is collected is only from the tanneries where it is pulled from the skins. This wool is very coarse and much inferior in quality. The wool industry was therefore entirely neglected.

Wool industry

Seeing that there is scope for improvement of this industry in this province, the Madras Government started selective breeding of Bellary sheep, the only woolly breed in Southern India, at Hageri Farm in Bellary district, about 20 years back. After 3 or 4 years work there, the entire flock was transferred to Hosur Cattle Farm where the work first started was continued and selective breeding on improved and systematic lines progressed to evolve a sheep superior to any other breed in the province, in quantity and quality of wool yield as well as quality of mutton. Thus the average wool yield per head of the flock of sheep at Hosur has risen from ½ to ¾ lb. of the original Bellary sheep to 3½ lb. in a year of two clips. The body conformation and weight also have increased considerably producing about 20 lb. more flesh than an average local Bellary sheep. Attention is also directed to improve the quality of the wool.

In addition to improving the indigenous Bellary breed, work has also been taken up to evolve a better quality sheep by cross-breeding Bellary ewes with Bikanir rams. This Bikanir breed is a northern Indian breed bearing finer wool, heavier in yield and better in conformation than the Bellary breed. This work is in its initial stage and only the first generation of the crosses have now come up, with performances very encouraging in all the three factors of quality and quantity of wool yield and in body weight. Seeing the improvement noticed at Hosur, Government have been purchasing for the past two years Bikanir rams from northern India and distributing them to shepherds in localities where woolly sheep exist in the province, so that the local sheep may be graded up to a better quality.

Improved shearing

Another important work done in the flock of sheep at Hosur is shearing by improved methods. Here sheep are well washed before clipping and then clipped by means of an improved shearing machine. By this method clipping is done uniformly and there is no wastage of wool. To popularize this method among the shepherds in the districts Government have sanctioned two sheep demonstration units, one for the northern and the other for the southern districts of the province. These units tour in sheep-breeding localities, demonstrate to the shepherds practically how the sheep are to be washed before shearing and then how they are to be clipped to get the maximum amount of wool.

At Hosur, wool analysis to determine the quality of the wool is also done, and by means of this process, the flocks will be improved in their quality by making selective breeding only, from such sheep whose fleeces are superior. In course of time, it is hoped that a breed suited to the conditions of southern India, superior in quality and quantity of wool yield and mutton value will be evolved, which would then be issued to the districts to improve the local breeds.

Sindhi herd

Cattle-breeding was started at Hosur in 1924 and the two main breeds selected for breeding purposes are Sindhi and Kangayam. The objects are to improve the milk strain of the Sindhi breed and supply good bulls to the districts where milk is required in large quantities. With regard to the Kangayam, though this breed is purely a draught one, yet attempts are being made to improve its milk yield also without detriment to the draught capacity of the animal.

The original home of the Sindhi breed was south-western Sind and this is the only commercially profitable dairy breed in the country. The foundation stock was obtained from Sind and by gradual and scientific breeding the milk yield of the farm herd was improved to such an extent that at present the average yield of cows per lactation is 4489·3 lb. with a daily average of 13·3 lb. as compared with 3,293 lb. and 11·3 lb. respectively of the foundation stock. There is thus an increase of 1,196 lb. per lactation. The average dry period of the farm-bred cows has also considerably decreased to 122 days as compared with 220 days of the foundation stock. So far two Sindhi

cows at this station have reached the highest milk yield record. Cow No. 132 yielded 11,448 lb. of milk with a daily average of 31·1 lb. and cow No. 143 yielded 10,081 lb. with a daily average yield of 27 lb. From the herd on this farm 48 cows have yielded over 4,000 lb. of milk during one lactation as detailed below :

Over 10,000 lb.	2		
7,500 to 8,000 „	3	5,500 to 6,000 lb.	2
7,000 to 7,500 „	3	5,000 to 5,500 „	8
6,500 to 7,000 „	2	4,500 to 5,000 „	12
6,000 to 6,500 „	4	4,000 to 4,500 „	12

Kangayam herd

This breed belongs to the Coimbatore district and is maintained on the station to produce animals true to type and supply them to the southern districts of the province for draught and other purposes. On this farm bulls become fit for service at the age of 2½ years, when they are issued for breeding purposes to outside stations. As a rule Kangayams are not good milk yielders, the average milk yield for the foundation stock having been 1,493 lb. with a daily average of 6·2 lb. Much progress in the improvement in milk strain of this breed has not been made but efforts are being made to evolve a good milk strain in this breed also, without affecting its draught qualities. There are however some individual good cows which have yielded more than 4,000 lb. of milk in a lactation. The following are the two good records :

	Yield per lactation	Daily average
Cow No. 164	4,135 lb.	13·6 lb.
„ „ 206	4,188 „	14·0 „

NORTH-WEST FRONTIER PROVINCE

By Ghulam Sarwar Khan, L.V.P.(Hons.)
Assistant Veterinary Investigation Officer (Poultry), Peshawar

For the last two years the necessity of holding provincial livestock shows were being keenly felt by the Civil Veterinary Department; but due to various reasons, chiefly financial, this idea could not be given a practical shape. During the last year the All-India Cattle Show Society decided to abandon temporarily the All-India Cattle Shows at Delhi and instead offered to provide money for prizes to various provincial Governments if they decided to hold regional shows for the recognized breeds of cattle, buffaloes, sheep and goats. This offer was gladly accepted and the first provincial livestock show was held at Peshawar from 14 to 17 April 1943 in which, in addition to the breeds for which money was provided by the All-India Cattle Show Society, other important breeds of cattle and buffaloes were also included and prize money provided from provincial funds.

First lievestock show

In order to give the show a true provincial character, arrangements were made to provide at Government expense transport facilities for selected animals from all districts and agencies of the province, and to further encourage entries of good animals, fodder was also provided free to all exhibits.

The long distances which the animals from districts other than Peshawar and from Agencies had to traverse for being exhibited at the show and the smallness of funds available for transportation of animals by rail or motor trucks were to some extent the limiting factors in the matter of number of entries, but the most important reason was the aim of the Department to enter only animals in show condition and those representative of various classes of breeds.

The Dhanni, pure and grades, which is the most important breed of the province naturally attained the peak figure of 208 animals comprising 52·5 per cent of the total exhibits. The next largest group was Lohani (41) from Kohat district and the Kurram Agency.

Sheep and goats were also exhibited at the show though the number fell far short of expectation. The exhibition of Angora goats and Damani sheep was the most interesting for the visitors.

The Khalsa breed of buffaloes and the Michni sheep were poorly represented, the main factor being the prevalence of haemorrhagic septicaemia in the Khalsa tract.

In the Dhanni breed there were four classes of animals, viz. bull, young bull, cow and pair of bullocks; in the Lohani there was a fifth class for heifers, while in the buffaloes the classes were for bulls, cows and heifers only.

This being the first show of its kind in the province it attracted very keen interest of the breeder, visitors and officers of the Government departments. Competition was hard and judgement careful, close and efficient and this was why the time taken for judging exceeded the scheduled time.

Handsome prizes

The most coveted prize of the competition was the Sir George Cunningham Challenge Cup for the best animal in the show, presented by Haji Fida Mohammad, Government contractor, Peshawar. This cup was won by a $3\frac{3}{4}$ years old Lohani bull named 'Ghamai' (meaning jewel) hailing from Parachinar. A young heifer from Mardan district was the most beautiful specimen of the Nili breed, and competed well against 14 other class champions in the Supreme Championship Class, all of whom were older than herself. Judging was very contested between this heifer and the Lohani bull and judges differed in the assessment of the values of these two animals. The Lohani bull, however, won by a narrow margin for being in better condition, but the heifer was awarded a special prize as an encouragement to the owner.

There were numerous other prizes in cups, medals and cash. Besides, certificates were also awarded by the Civil Veterinary Department to the owners of prize winners. The Acheson Cup for the best sheep in the show was won by a pen of three Hashtnagari ewes exhibited from Tangai village of Peshawar district. The Major Dring Challenge Cup was won by a Dhanni bull from Hazara district and the Raja Mohammad Nazir Challenge Cup by a young Dhanni bull from Bannu district. The Nili heifer, Leila, from Mardan district won the S. M. Sarwar Challenge Cup as well as a special prize for the second best animal in the show. The large silver medal donated by the Civil Veterinary Department was not awarded on account of the poorness in number, condition and type of Khalsa buffalo bulls, while the small medal went to a Lohani cow from Kohat district.

Governor's visit

The interest of the public was much enhanced by the visit of His Excellency Sir George Cunningham, the Governor of N.-W. F. Province and Lady Cunningham, Mr Acheson, Advisor to the Governor, and Mrs Acheson and various other high officers of the province to the show grounds. His Excellency, who is very keenly interested in livestock improvement work of the province, went round the exhibition arena and saw every winner of the various classes of animals represented at the show and made searching enquiries from the owners and the departmental staff.

There were many distinguished visitors both from the official circle and the leading *Khans* from rural area, who were all greatly interested. Mr Gossip, Secretary, All-India Cattle Show Society, rendered very valuable assistance in the judging ring and in various other activities of the show. The members of the Executive Committee and the department very much appreciated his services.

Owners of prize winners and the distinguished guests were entertained to tea and an address was presented to His Excellency in *Pushto* along with a purse of Rs. 1,971-15-3 on behalf of the cattle breeders of the province.

Recreation and propaganda

The show was a great success and created interest and enthusiasm among the breeders and practically all visitors enquired about the possibility of continuing the show in future years. The show was held on the capacious green lawns of Shahi Bagh situated to the north of Peshawar city. The parapet round the show ground offered by the District Board, Peshawar, the microphone and loud speakers installed for various announcements, flags and festoons, well laid out roads, cattle pens and judging ring, the officers' tents and shamianas, the exhibition stalls, the stalls of the various Government departments, the police camp and the recreation and propaganda afforded by the National War Front all formed an artistic picture. The drama on rural uplift by the Cooperative department, the tent-pegging, the tug-of-war, wrestling, the music arranged by the National War Front and the police band added greatly to the attraction of the show.

TRAVANCORE

By K. R. Ramachandran Nair, B.Ag.
Agricultural Inspector, Travancore

PLANTAINS of several varieties are extensively grown all over Travancore, and it will not be an exaggeration to say that there is not even a single holding in the state without a few plantain trees. Like the coconut, plaintain products are put to a variety of domestic uses, so much so that the plantain occupies a very important place in Travancore's rural economy. The leaves of the tree are used as plates for taking food, and for culinary purposes in the raw state. The leaf sheaths are dried in the sun and used for cordage. The fruit stalk is regarded a dainty, having certain medicinal properties which make it extremely useful for cooking purposes. The juice of the plantain tree is regarded as an efficient antidote for food poisoning, especially in animals.

Bunchy top disease

During the last quarter, a severe outbreak of bunchy top disease occurred in plantain trees in Northern Travancore. The disease has been well-known in Ceylon, Australia, and New Zealand. It appeared in Travancore for the first time, and the source of infection is not known. The infection, however, spread so rapidly that it appeared to aim at the total extinction of so important a crop, as described above, in the country.

The research section of the University of Travancore took the problem in hand immediately, and in a very short time the disease was identified, and necessary steps to control the outbreak were taken in collaboration with the Department of Agriculture. The disease was promptly notified by Government under the Plant Pests and Plant Diseases Act of Travancore. The Divisional Agricultural Officer Moovattupuzha was appointed Special Officer under the Act, and control measures were promptly set in motion. All over the world, wherever the disease has been raging in the past, it has been found that the total destruction of the affected plants was the only effective remedy against the disease. These measures were therefore taken by the special officer and the spread of the disease has been effectively checked. Further work is proceeding.

Manure scarcity

During the June-July rice season Travancore faced a very acute manure scarcity. Oilcakes and bonemeal are the manures usually employed in the state. Neither of them is however produced in sufficient quantity to meet the requirements. There is a small production of oilcakes, but practically no bonemeal is produced here. Raw bones, available in the state, were being exported until recently, and the stuff was returned to the state as bonemeal. In view of the requirements of the country, Government recently prohibited the export of raw bones and bone products from the state. One or two bone crushing plants were installed by some local merchants, but the output could not meet the demand. At this critical stage, the Government of Madras unexpectedly prohibited the export of oilcakes and bonemeal from the province. Travancore was thus placed in a very awkward position with regard to manure supplies. Enquiries were immediately made in other provinces for manure supplies, and by September offers were received from Bombay and Hyderabad for supplies to Travancore. The Government accepted the offers gladly and large stocks of the required manures have already arrived by rail and steamer.

The Sri Chittra Exhibition

A grand exhibition of indigenous industries was held during the birthday week of H. H. the Maharajah. The Agriculture Department stall was well set up. Alternative food crops of the country were all exhibited in an impressive manner.

Sericulture in Travancore

Thirty years ago the Travancore Agriculture Department had a sericultural branch. The Salvation Army too worked in conjunction with this department then to develop sericulture as a cottage industry in the state. The scheme worked fairly well for a few years. The advent of cheap Japanese silk gradually pushed sericulture to the background in Travancore, and the entire section had to be abolished subsequently. Recently, however, Sachivothama Sir C. P. Ramaswamy Iyer, Dewan of Travancore, observed that sericulture has immense possibilities as a cottage industry in Travancore, and took steps to revive the industry. The

department has planted two large mulberry farms already, and the rearing of silkworms has also begun. It is hoped that in a very short time sericulture will be established as a profitable industry in this state.

Cattle improvement

Travancore cattle are a motley herd of non-descript specimens with practically no outstanding characteristic at all. Efforts to improve them have already been proceeding for some years now. The question of keeping an adequate supply of good breeding bulls has been engaging the attention of Government for some time past. A scheme to open a stud bull farm has been recently sanctioned by Government. Ten Sindhi bull calves obtained from the Palace Dairy farm is to form the first lot. Arrangements are already under way to open the institution at Puliyara, near Shencotta, where plenty of natural grazing is available.

Vegetable production

Supply of vegetables to the city markets was formerly made by farmers living outside the city. It was possible until a year ago to purchase one's vegetable requirements from the city markets in abundance and at reasonable prices. The situation steadily deteriorated day by day, as so to make it practically impossible for consumers in the city to procure vegetables, at prices within the reach of the average buyer. The position can be imagined when considered side by side with the fact that more than 70 per cent of the people show marked preference to an exclusively vegetarian diet.

A vegetable growers' cooperative society came into being a few months ago, as a result of the above state of affairs. The society distributed seeds of vegetables to its members for cultivation in their backyards, and provided whatever other facilities it could. Members were required to give over to the society their surplus for sale at reasonable prices to other consumers. The society is making rapid progress and the situation has eased considerably in consequence.

Seeds of vegetables are now on display in a large number of shops in Trivandrum, which would show how far vegetable growing has been caught on by the people, especially when we consider that seeds of such crops were never before on sale in Trivandrum shops.

Manufacture of fertilizers

The war has made it practically impossible to obtain supplies of artificial fertilizers. Travancore has been consuming several thousand tons of sulphate of ammonia, superphosphate, nicifos and amophos, annually. The supplies have ceased suddenly, this and other circumstances, compelled the Government to find her own sources of supply. The necessity for large stocks of manures at cheap prices is vital and absolute now, for growing more and more food. A company named 'The Travancore Fertilizers and Chemicals Ltd.' has been registered in Travancore recently, with an authorised capital of Rs. 1 crore. The company has already begun its activities, and the Government of Travancore have taken shares to the value of Rs. 12½ lakhs. It is believed that before long, Travancore will be producing her own fertilizers.

CATTLE, SHEEP AND GOAT SHOWS IN SIND

By

ALI MOHD. ULVI, B.AG., *Livestock Officer in Sind*

and

JOTE D. ADVANI, *Inspector of Livestock*

THE provincial cattle, sheep and goat show for North Sind was held at Jacobabad from 1 to 4 March 1943. Along with this show, other shows like the horse and pony, Agri-horticultural, Industrial, National War Front and side exhibitions were held over wide grounds which are adjacent to the town of Jacobabad. A large number of cultivators, maldars, breeders and distinguished jagirdars and zamindars attended.

The features of cattle, sheep and goat shows included selected exhibits of Bhagnari cattle, cows, heifers, bulls and pairs of bullocks from various breeding areas in north Sind. Among

young bulls, could be seen progeny from Government stud bulls, stationed at various places under His Excellency the Viceroy's cattle improvement scheme. The Bhagnari breed is mainly draught adapted to very hard conditions prevailing under the extreme temperatures of north Sind. The cow is a moderate milker and is mainly utilized for rearing her young ones on a large portion of her milk yield. The surplus is utilized for the domestic use of the cultivator. On account of a liberal feed of milk to the calves, the response in quick growth of young stock in the Bhagnari region is well-marked.

Points of the Bhagnari breed

There are two types of Bhagnari :

(a) The heavy type animal, which is bred and reared in the Bhagnari tract of Baluchistan.

(b) A smaller breed of medium size adapted to conditions of north Sind.

The medium sized animal is found well suited to the agricultural needs of the right bank of the Indus in Sind. The animal is hardy, energetic and capable of strong draught power, which is essentially necessary for *bosi* or dry cultivàtion and *wet* or rice cultivation prevailing in north Sind. The animal is also quite suited to carting and transport over long distances. The animal is reared by the cultivators and cattle-breeders as a pet animal of the home, and is very carefully looked after by children. On this account the characteristic of quick growth and early maturity is ingrained in this breed.

The cow, after feeding the young one, gives about 10 lb. of milk daily. Heavy milkers, yielding about 25 to 30 lb. after feeding the calves have also been noticed in the breed. At the Jacobabad Cattle Show, in the milking competition the Bhagnari breed was defeated by the Red Sindhi cow, but the best Bhagnari yielded 14 lb. of milk after feeding its calf. The best animal at the show was also a Bhagnari cow, which looked very handsome and her colour was silver-white all over the body with a large black switch.

Other breeds included the Red Sindhi cow which is imported from Karachi for milk. The Red Sindhi cow has to be acclimatized in north Sind on account of severe climatic conditions ; likewise the Thari cows brought here for milking. The local country cow is graded and improved through selected Bhagnari bulls from dams of high milking reputation. Such cows were also brought to the milking competition. The yields ranged from 10 to 15 lb. per day.

Kundhi buffaloes are well looked after and reared throughout Sind, and in north Sind the biggest markets exist at Shikarpur and Sukkur. These buffaloes are of medium size and the best animals go up to 40 lb. of milk per day. Milkers of 20 to 30 lb. are common. The colour—entirely black—is common, but grey animals are also found. The best buffalo cow yielded 29 lb. at the show.

Sheep and goats

The lighter description of stock, namely sheep and goats, also represented the district. The Dumba sheep is common here and supplies the bulk of mutton in the cold weather. The animals as a rule are spotted—black and white—but careful shepherds have been selecting entire white stock for their breeding. There is a good market for wool in this area and a wool mill is working at Shikarpur for this centre.

The goat of this locality represented (a) the Leri breed, which supplies mutton as well as milk in the locality, (b) Bari, which is a fancy animal and a milker reputed with producing sweet milk for infants and invalids, (c) a larger breed than the Bari and without horns called Thori Bari, and (d) Kamori, also met with.

All these breeds were represented at the show. There was keen competition in all classes of livestock. The judges included : Mr A. F. Mir, Zemindar, Jhudo-Sind ; and Mr Jafar Khan Burdi, M.L.A., Jacobabad.

The prizes were awarded by the Hon'ble Minister for Revenue, Khan Bahadur Khohro, in the presence of a very large gathering.

The prizes awarded by the All-India Cattle Show Committee, New Delhi, amounted to Rs. 624 and by the District Local Board, Jacobabad, amounted to Rs. 370.

Hyderabad show

The first Provincial Cattle show for east and south Sind was held at Hyderabad from 28 to 30 March 1943, in conjunction with the National War Front Conference.

The show was arranged on the outer margin of the city on the Domanwah grounds. In spite of short notice to the breeders and maldars the response was satisfactory. Quality of stock exhibits as considered by judges was declared to be good.

The breeds represented : Red Sindhi and Thari Cattle; Kundhi buffaloes and sheep and goats of the locality.

The Red Sindhi breed is purely the milking cow of Sind representing parts of Hyderabad, Karachi and Kohistan tracts. She is *par excellence* milch cow and is in great demand in other parts of India and overseas. Hence the industry of breeding and improving the Red Sindhi cow is an important one for the province of Sind.

The Thari is a dual purpose breed. The cow is a good milker, while the bullock is an excellent draught animal. The best cow of this breed yielded 25½ lb. of milk and carried the highest prize, beating even the Red Sindhi cow which entered the competition. The work cattle represented by pairs were big ones and the best prize of bullocks went to a cultivator whose specimens were both alike in body conformation, colour and size.

The Kundhi buffalo supplies the bulk of the ghee of the province and inhabits canal areas as well as wet rice areas of North and South Sind. This class exhibited well-bred stock of jet black specimens.

Among the class sheep and goats, the response was not large, but the stock which competed were typical of the local breeds.

The prizes were awarded by the Collector of Hyderabad in the presence of cattle owners and cattle breeders of the area. The All-India Cattle Show Committee, New Delhi, provided funds for the prizes.

MILK RECORDING NEWS

During October 1943, eight buffaloes and 31 cows completed their lactations, for which records are available under four village milk recording schemes of the Council. The buffaloes averaged 4,966 lb. and the cows averaged 2,353 lb. The highest yields were 7,467 lb. for a Murrah buffalo in the Meham area (Rohtak district) and 5,423 lb. for a Red Sindhi cow in the Trivandrum area (Travancore). Records for individual breeds are as under :

Murrah buffaloes

Meham area (Rohtak district, Punjab). Seven buffaloes completed their lactations, averaging 5,162 lb. The highest and lowest recorded yields were 7,467 and 3,665 lb. respectively. Selected records are as under:

Tattoo or Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
M.B.126	Pokar S/o Ramjilal	4	16.11.42	331	7467	36
M.A.8	Shoe Datt S/o Mattoo	4	23. 8.42	390	4620	24
N.D.13	Phul Singh S/o Dhan Singh	8	15. 9.42	322	5308	34
N.D.17	Shib Lal S/o Dharma	5	19. 8.42	428	6848	28

Local cattle and buffaloes

Chata area (Muttra district, U. P.) Only one buffalo completed a full lactation during October 1943, yielding 3,590 lb. Seven cows, which completed their lactation during the month averaged 1,718 lb. with a maximum of 2,143 and minimum of 1,085 lb. Selected records are given below :

Tattoo or Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
148 Buff:	Bhajanlal	1	2.9.42	417	3590	13
200 Cow	Jangi	2	12.12.42	312	2143	9
272 „	Bulli	4	1.2.43	244	1662	10
46 „	Tursi	5	28.9.42	377	2103	8
252 „	Nekasing	2	25.1.43	265	2045	13

Hariana cows

Records are available from the Beri area, Rohtak district, Punjab. Seventeen cows completed their lactations during October averaging 2,572 lb. The highest yield was 4,134 lb., and the lowest yield was 1,717 lb. Selected records are as under :

Tattoo or Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
GS. 3	Sobha S/o Daya Ram	5	3.12.42	317	4134	22
KM. 331	Patram S/o Daula	5	4.12.42	303	3109	16
KM. 317	Patram S/o Daula	4	17.1.43	279	3040	16
DM. 20	Richhpal S/o Amand	4	25.11.42	325	3024	21
DB. 36	Sukhiram S/o Badlu	1	18.11.42	332	2961	15
DB. 24	Chandgi S/o Dhiro	2	16.11.42	324	2889	11
BP. 4	Sultan S/o Mohanlal	3	2.1.43	275	3077	21
SR. 22	Chandgi S/o Arjan	2	20.11.42	333	2805	19

Travancore cattle

(Area Trivandrum). Records for two months September 1943 and October 1943 are available. During September 18 cows, including two Sindhi graded cows, completed their lactations, averaging 2,109 lb. The highest yield was 5,161 lb. and the lowest 990 lb. During October seven cows, including one pure bred Sindhi, completed their lactations, averaging 2,453 lb. The highest yield was 5,423 lb. given by a Sindhi cow. The maximum yield for a local cow was 2,170 lb. Selected records are as under :

Tattoo or Brand No.	Name of owner	No. of lactation completed	Date of calving	Date of drying	Milk yield lb.
TR. 80	Kuttan Pillai	4	15.10.42	10.9.43	4129
TR. 123	Chellappan	1	29.10.42	15.9.43	4203
TR. 126	do	4	20.11.42	18.9.43	2160
TR. 139	D. Vareed	3	8.12.42	8.9.43	2302
TR. 140	do	4	12.12.42	20.9.43	5161
TR. 149	Kunjuraman	3	17.11.42	12.9.43	3653
TR. 74	Ponnen Paniker	1	7.11.42	2.10.43	3360
TR. 124	Chellappan	2	3.11.42	4.10.43	5423
TR. 176	D. Varied	2	16.2.43	8.10.43	2170

THE 7,500 LB. BUFFALO CLUB OF INDIA

FOLLOWING are the records of two Murrah buffaloes of the Government Military Dairy Farms Department, stationed at Ahmednagar and Mhow. One of them is a purchased animal and the other is the daughter of a purchased animal. Details of ancestry are therefore scanty.

MANKI, a daughter of Ardent out of dam Manso, was purchased on 8 September 1933 and has completed 6 lactations. The dam Manso was herself an outstanding animal yielding 6,912 lb. in 321 days in her best lactation and having exceeded 6,000 lb. in five out of her seven lactations. Manki's milk records are as follows :

Date of calving	Date of drying	Milk yield lb.
15.8.36	17.7.37	6265
29.11.37	1.3.39	9155
20.7.39	17.4.40	7256
14.7.40	22.5.41	6442
29.8.41	23.7.42	6488
4.11.42	22.8.43	5317

SADHO, a Murrah buffalo at the Military Dairy, Mhow was purchased on 5 February 1926. Her pedigree is not known. She has completed 5 lactations qualifying for entry to this club in her 4th and again in her 5th lactation as shown below :

Date of calving	Date of drying	Milk yield lb.
5.2.36	21.1.37	5230
30.5.37	5.5.38	6802
24.3.39	16.11.39	4648
27.2.40	27.2.41	8103
10.6.41	21.5.42	7553

21
363
324
757

The Month's Clip

FOOD FROM THE RECLAIMED SWAMP LANDS

By J. A. Miles

MUCH of the swamp lands found by the sides of rivers and small streams that is useless for food production purposes can be transformed into serviceable arable or grazing land by the simple expedient of building an earthwork embankment along the waterside. Land so reclaimed will provide stock with an abundance of lush vegetation during the most prolonged spell of drought, and, with suitable cultivation, vast quantities of essential food-stuffs for men and beast. It is usually found that the water supply of localized bogs and marshes has its origin in the overflowing of the main stream during bad weather, or from a continuous seepage of the water through a porous natural bank. Inspection of a particular site will quickly diagnose the exact source of the trouble and enable work to be carried out in order to stop either flooding or seepage.

To ensure stability and prevent seepage it is essential that the embankment should be impervious to water throughout the whole length of its structure, and while skilled labour is not at all necessary for the successful carrying out of the work, it is advisable for the man in charge to know something of what he is about. In the case of an embankment erected to prevent surface flooding the operation is simplified, as it is merely necessary to build a bank of suitable material and in a proper manner, but where seepage is the trouble it is necessary to excavate the footings of the structure to a sufficient depth to reach a retentive and solid subsoil.

The height of the banking must be sufficient to prevent any flood water from washing over, for apart from frustrating the object for which the embankment is erected, the flood water speedily finds its way to the centre of the structure and rapidly destroys the work. Generally speaking, the slope of the banking next to the water should be built at an easy angle ; usually it is made much too steep and suffers accordingly from the action of the swiftly moving water, 20 degrees is sufficient in most cases and with a strong current to contend with the width of angle should be even more. The illustration gives a general idea of the layout for a swift-flowing stream embankment and shows the foundation sunk into the solid subsoil to prevent seepage, as well as an additional ditch to carry off any water which may chance to percolate through ; this latter addition is, however, seldom necessary if the wall and its footing have been constructed in a thorough manner.

Having marked out the site of the embankment by means of line and stakes, the surface turf is removed with care and stacked to one side, for it will be found of great value in covering the completed slopes. Should the soil be of a solid nature the removal of the turf is all the preparation that is required. If, on the other hand, it is porous the trench already mentioned as forming a footing must be dug, taking care that it extends downward to a sufficient depth to reach the solid subsoil. The width of the trench may be governed to some extent by its necessary depth, for while a deep trench must be of a width to assist in the easy removal of the soil, it naturally follows that the greater the amount of surface water to be dealt with the wider will the foundation require to be. Thus the width is automatically regulated by the depth to which the trench must be excavated.

The necessary excavating having been completed (and it is assumed that a seepage trench has been dug) the trench is filled in such a manner as to render it impervious to seepage water, by what is termed 'puddling'. This process consists, briefly, of placing a layer of stiff clay into the bottom of the trench, then a layer of gravel and ramming or 'puddling' the surface down until the gravel is driven into the clay and a solid bottom is made. The process is repeated, layer by layer, until ground level is reached, when construction of the embankment is carried forward in the manner about to be described. Working layer by layer, and sloping the surface as the work proceeds upward, the embankment is built up from any suitable available material such as clay, peat, soil or any other suitable material, each layer being thoroughly rammed and separated from its neighbour by an alternate

layer of coarse gravel, stones, or rubble, the whole being thoroughly incorporated by ramming. As this part of the work proceeds it is necessary to carry on with that of the seepage barrier as well, should this form part of the constructional work ; the procedure being the same as that already described for the work below ground level.

Having brought the embankment up to the required height, the side facing the stream may, with advantage, be faced with stone, this procedure being almost a necessity where swiftly flowing current has to be contended with, or repair work will be required shortly after a heavy flood. The stones should be as large as possible and should be laid on their edges, with the faces lying at right angles to the slope. Ram the stones well into the surface of the embankment, bonding them with soil or heavy clay, and on the surface so formed, lay a second layer in a similar manner, working smaller stones in with the bonding where large spaces occur between the larger members. Such a surfacing will resist the action of the heaviest flood and should seldom, if ever, require any attention or repair.

In conclusion, it should be pointed out that it is seldom necessary to run such an embankment as that described along the whole length of a riverside field, for the natural banks of the stream, in most cases, protect the land by their height from everything but the heaviest of floods. Flooding and seepage usually occur where the bank has been broken down or washed away and the stream so allowed to make inroad into the land ; the openings gradually extending deeper and deeper as each storm brings down more water. Such places require treatment, and it will be found that if these inroads are attended to in the manner suggested there will be little cause for complaint of land being held up from food production through being water-logged. *The Field*, 13 February, 1943.

CONTROL POULTRY LICE AND MITES

EFFICIENCY in the management of poultry flocks, particularly farm flocks from which the bulk of egg production in Canada comes, was never more necessary than now among poultry producers. The desired efficiency cannot be reached or maintained unless lice and mites are controlled. Many species of lice are found on poultry, the most prevalent being the common body louse which frequents the region about the vent of hens and the head louse found on the head of young chickens. Several effective methods of treatment are known for the control of body lice. Dusting with sodium fluoride from a tin with a perforated top is one way. Another method is dipping the birds in a solution of 1 oz. sodium fluoride to one gallon of water. This should be done only when the weather is warm. Sodium fluoride is cheap and can be bought at any drug store. The application of nicotine sulphate to the roosts just before roosting time is also effective. It is applied at the rate of about 8 oz. to 100 ft. of roosting space. Treatment with either sodium fluoride or nicotine sulphate should be repeated at intervals of 10 days. Head lice can be controlled by the application of a small amount of melted lard, vaseline or other mild grease to the top of the head of each chick. Mites are tiny creatures that live in the crevices of the poultry buildings and suck blood from the bodies of the birds during the night. Used crank case oil, diluted with kerosene and applied to the roosts, their supports and to cracks and crevices in the buildings, will prove effective. There are prepared sprays that are good, so too are nicotine sulphate and coal tar dips in 10 per cent solution.—*Dominion Department of Agriculture, Canada*.

LEGUME INOCULATION

FOR many centuries it has been recognized that plants belonging to the legume family—beans, peas, clovers, vetches, alfalfa and others—differ in a striking way from other cultivated plants in the effect of the growth of crops on the state of fertility of the soil. Whereas all non-legumes are dependent upon the supply of nitrogen in the soil, the legumes are able to draw on the unlimited quantity of this element in the air.

In order to make use of the nitrogen in the air, legumes require the cooperation of bacteria, and that without the proper bacteria they are forced, like non-legumes, to depend upon the nitrogen in the soil. These useful nitrogen gathering bacteria, if present in the soil, enter the roots of the legumes, where they grow and multiply, stimulating the root to grow a small knot or tubercle, commonly called a nodule, at the point at which they enter.

Just how this inoculation with its beneficial effects is effected is fully explained in the War Time Production Series Pamphlet No. 32 'Legume Inoculation', which may be obtained free by writing to the Publicity and Extension Division Dominion Department of Agriculture, Ottawa.—*Dominion Department of Agriculture, Canada.*

SOYBEANS IN THE FRASER VALLEY

EXPERIMENTS conducted at the Dominion Experimental Farm, Agassiz, B.C. over a period of years, have disclosed that soybeans can be grown to advantage on many Fraser Valley farms. The soybean, with its protein content of 35 to 40 per cent is the richest of all seeds in this respect and can replace oilcake pound for pound in the feeding of dairy cattle.

Up to the present, however, soybeans have not been grown to any appreciable extent and sometimes efforts to grow this crop have met with indifferent success, principally due to the fact that soybeans have certain limitations under local conditions and these limitations must be understood before consideration is given to the production of the crops.

In the Fraser Valley the growing of soybeans for seed has been more successful than efforts to grow them for hay, states M. F. Clarke of the Experimental Farm, Agassiz. Seed production is limited to early maturing sorts, while on the other hand if soybeans are to be used for hay later kinds are necessary if satisfactory yields are to be obtained, and these have the disadvantage of being ready for harvest at a time when weather is unsuitable for curing.

Like corn, soybeans require a warm season and as these conditions prevail for a short period in the Fraser Valley early sorts are required. Only those sections which produce satisfactory yields of corn for silage should be used for soybeans provided approved varieties and cultural methods are used.

The varieties recommended for local conditions are, in order of maturity, as follows : Manitoba Brown, Pagoda, Kabott and Goldsoy. Manitoba Brown is a brown-seeded sort and is the earliest, requiring approximately 119 days to mature at Agassiz. Pagoda and the remaining sorts are yellow-seeded. This variety matures only two or three days later than Manitoba Brown and yields approximately the same. For the past three years these varieties have averaged about 25 bushels per acre in small tests. Manitoba Brown has a tendency to shatter when ripe, a characteristic not pronounced in the yellow-seeded kinds. Goldsoy and Kabott rank closely in maturity and are approximately 12 days later than Pagoda. Of the two, Goldsoy has given slightly heavier yields, the test average for the past three years being 27·2 bushels as against 24·7 bushels for Kabott. These yields have been obtained from small plots and are slightly higher than might be expected under average field conditions. Yields in excess of 15 bushels per acre should generally be profitable. From the standpoint of protein 15 bushels of soybeans are equivalent to approximately 90 bushels of oats.

Further information with respect to the growing and feeding of soybeans can be obtained from the Superintendent, Experimental Farm, Agassiz, B. C.—*Department of Agriculture, Canada.*

COMPRESSED DRIED MILK

PROMISING results are being obtained in some Australian investigations into the production of export blocks of compressed dried milk.

Full cream powdered milk ranks high in the priority of foodstuffs sent to Great Britain under present conditions. It retains the nutritive elements of fresh milk in their original proportion, as only water has been extracted from the milk. It has been found, however, that in course of time the air surrounding the grains of the powder causes a small amount of decomposition. For that reason, dried milk is now packed in tins in which the air has been replaced by nitrogen. The product in tins so packed keeps satisfactorily for a considerable time.

The supply of tinplate, however, is nowdays somewhat difficult, and moreover, it has been realized that a considerable amount of valuable freight space could be saved if the dried milk were compressed into blocks and not packed in tins at all. It is believed that such compression would prevent the air reaching individual grains of the milk and thus decomposition would be avoided.

Investigations have accordingly been put in hand by the Council for Scientific and Industrial Research, acting upon a suggestion from the Department of Commerce. The results have

shown that under high pressure, dried whole cream milk powder can be moulded into a firm block and the volume reduced by more than one-half; 33 lb. of the powder can be compressed into a cube, each side of which is about 9 inches long. This block contains the food material from 26 gallons or 208 pints of milk. The blocks can be powdered and beaten up in water to reconvert them to milk.

Arrangements are now in hand to send a trial shipment of half a ton to Great Britain.

Arising out of the trial shipment, the High Commissioner's Office in London has reported to the Commerce Department that the British Food Ministry is definitely interested in the matter and in view of the restrictions on butter export, has been induced to take the long-range view of dried milk possibilities. The Ministry has asked whether Australia would be interested in offering substantial quantities of full cream roller powder, and mention something like 20,000 tons per annum from Australia and New Zealand. In the United Kingdom, when liquid milk is short, full-cream powder would be more attractive than pure butterfat with which Australia is also experimenting.—*Dairy News Letter, Canada, March 1942.*

A CULLING STANDARD FOR COWS

THE culling of poor producers is important in dairy herd management especially with the labour shortage so acute. The first step in intelligent culling of the herd is to keep accurate records of the production of each cow, says W. M. Fleming, Dominion Experimental Station, Summerland, B.C.

After the production of each cow in a herd is definitely known the owner should decide on his culling standard. This standard will depend upon the variation and the average production in a particular herd and also on the relative cost of production. It should be set reasonably high and revised upward at intervals as the quality of the herd improves. Animals failing to reach the desired production should be sold. It should be kept in mind that young cows should not be expected to attain the production of cows 5 years of age or older. It is likely that the cow that proves to be a poor producer with her first calf will always remain so unless there is some special reason for her first year's production being low.

There are two main considerations in obtaining high milk and butterfat production. The first is the inherited ability, the second the feed and care given to the cow. Every cow inherits a certain maximum milk and butterfat producing ability above which she will not go even though she is fed and cared for in the best possible way. If the cow is not fed a sufficient amount of the right kinds of feed she cannot produce to the maximum of her inherited ability.

It is difficult to judge accurately the producing ability of a cow from her appearance. A good dairyman may be able to tell the difference between a good and a poor cow, but even the best judge may not be able to pick out a 300 lb. fat cow from a 400 lb. fat cow. The difference lies chiefly in percentage of butterfat and persistency of production; that is, the ability to produce milk at a high level to within 6 or 8 weeks of her next freshening. The only way to determine accurately the annual milk and butterfat production of cows is by some system of milk weighing, testing and recording at intervals throughout the lactation.

Controlled prices for feed and for dairy products, coupled with Canada's urgent need of milk, cheese and butterfat make it imperative that poor cows be weeded out but all good producers retained for further production. A cow failing to reach the standard under intensive production where much feed is purchased and costs are high might be profitable in a herd where the cost of production is lower.—*Department of Agriculture, Canada.*

LIFE OF MANGO BUDWOOD

IN an article entitled 'Mango Budding *in Situ*' which was published in April 1943, a detailed account of the present method of mango propagation and its limitations and the new technique of mango budding was given. The Fruit Section was in consequence flooded with requests from fruit growers to take up this work on their lands. As it is not possible to take up this work on a large scale with the present staff, which is inadequate even for the work already in hand, it is highly desirable to furnish the fullest information on the subject to help mango growers and nurserymen to take up this work themselves.

In the article referred to above, the method of preparing budwood from the scion trees (trees of superior varieties that are desired to

be established) was discussed. No mention was, however, made as to how the budwood could be transported to distant places. The life of mango budwood is very short and unless utilized for budding within a few hours after removal from the tree, it becomes quite useless. Unless there is a way of prolonging the life of budwood, the utility of this new method of mango budding *in situ*, will therefore be confined to only those places which have got scion varieties on the spot or in the immediate vicinity from where desired budwood can be obtained. In order to prolong the life of mango budwood, investigations were also conducted simultaneously with the other investigations already reported.

The object of this article is to give in brief the method by which the life of mango budwood can be increased from a few hours to a couple of days without affecting its efficacy. We have been able to keep it in excellent condition for 48 hours by following the method given below. This method will therefore enable mango growers to transport budwood from considerable distances.

1. Cut the prepared budstick from the scion tree, taking care that cuts at both ends are made at least $1\frac{1}{2}$ in. away from the sound buds at the extremity of the bud stick.

2. Dip both the cut ends of the budstick in melted paraffin wax just for a second and immerse the waxed ends of the budstick immediately in cold water. The ends of the budstick should not be dipped more than $\frac{1}{4}$ in. in the melted paraffin wax as it is likely to cause injury to the adjoining bud. The dipping of the cut ends of the budstick in paraffin wax is very essential to stop 'bleeding' from the cut ends ; otherwise all the white milky sap oozes out within a short time, rendering the budstick dry and unfit for use after a few hours.

3. Tie the budsticks thus treated into suitable sized bundles which can be conveniently placed in a thermos bottle (food jar, wide-mouthed).

4. Take a thermos bottle of suitable size (seven or eight pints capacity bottles are quite suitable for this purpose). These can hold about one hundred buds. Small-sized jars can also be used if fewer buds are required to be transported. Rinse the bottle with ice-cold water two or three times till it is sufficiently cool inside.

5. Add ice-cold water to the thermos bottle just enough to be about $\frac{1}{4}$ of an inch deep at the bottom of the bottle and then place the bundle of budsticks therein, closing the lid. The water in the bottle will keep the inside air cool and humid, and the budwood will remain fresh. Ice should never be put into the bottle along with budwood as buds may be damaged by chilling, especially if the quantity of ice added is considerable.

6. If it is desired to keep budwood in the bottle for more than 24 hours, then take the budsticks out after 24 hours, rinse the bottle with water and pour a little cold water in the bottle as before and put the budsticks back again, closing the lid.

Where ice is not available ordinary cold water alone can also be effective.—LAL SINGH, Fruit Specialist, Punjab, and ABDUL AZIZ KHAN, Fruit Section, Lyallpur, *Punjab Fruit Journal*, April 1943.

New Books and Reviews

THE TREATMENT AND DISPOSAL OF WASTE WATERS FROM DAIRIES AND MILK PRODUCTS FACTORIES

(Department of Scientific and Industrial Research, Water Pollution Research, H.M.S.O., London, 1941, pp. 125, 4*s*.)

AT a recent meeting of the Advisory Board of the I.C. of A.R. the question of pollution of fishing waters was discussed and the point was made by some speakers that before recommending the stoppage of such pollution, we should be in a position to explain how the bad effects of the effluent might be neutralized.

The paper under review is an example of how such subjects are tackled in England, for it is pointed out that the waste washing waters from dairies require treatment before they can be considered suitable for discharge into a river or stream, and the Water Pollution Research Board took part in the experiments designed to counteract the nuisance.

After giving a general introduction to the subject and presenting an idea of the nature and quantity of wasted waters from dairies and milk products factories, the ways and means of reducing the quantity of milk, whey and other polluting matters carried away with the waste waters by simple modifications in the factory processes, the enormous polluting effects of such washings and the scope for utilizing such by-products for the manufacture of food materials, the various laboratory and large-scale experiments carried out on the different methods of treatment of waste waters have been described. Two methods, viz. (i) filtration through two percolating filters in series with periodical change in the order of filters, and (ii) aeration in admixture with activated sludge, were found to be satisfactory and of the two the double filtration process was found to be more economical and convenient, and also the rate at which milk and whey washings were treated to give effluents of good quality by this process was considerably higher than is usual in the treatment of domestic sewage.

From the results of the investigation the following recommendations are made for the treatment and disposal of waste waters from the milk industry.

(1) By-products, such as skimmed milk, buttermilk, and whey should not in any circumstances be discharged with the waste waters from a factory. These liquids should be used for feeding stock, or for the manufacture of food materials or other substances.

(ii) Every effort should be made to reduce the quantity of milk, whey, and other products and by-products carried away with the waste waters. Considerable reductions in the volume and strength of the waste waters can be made at many factories by simple modifications in factory processes and careful supervision.

(iii) When these precautions have been taken, the waste waters remaining for disposal can be efficiently purified by the process of double filtration. The plant should include a storage and balancing tank of sufficient size to allow the filters to be supplied at a constant rate throughout the 24 hours of the day. The period during which the waste waters are retained in the storage and balancing tank should be no longer than is necessary to ensure even flow, since if the liquid is retained for long periods it undergoes extensive fermentation with the production of further quantities of sludge, and there may be nuisance from odour. Crude waste water, after sedimentation and if necessary after dilution with water or with final effluent to give a mixture with a biochemical oxygen demand not greater than 30 parts per 100,000 parts, should be supplied to the primary filter at a rate not exceeding 320 gallons per day per cubic yard of medium in the primary filter. After sedimentation in a humus tank, the liquid should then be supplied to the secondary filter at the same rate. Effluent from the secondary filter should be allowed to settle in a humus tank before being discharged to a stream. The rate at which the settled and diluted crude liquid is treated in the plant should thus not exceed 160 gallons per day per cubic yard of medium in the two filters together. At intervals of about two weeks the order of the two filters in series should be reversed.

The information given in the paper will serve as an excellent introduction to scientists and others who are very familiar with the subject. Useful appendices giving notes on the

methods of analysis of crude waste waters and treated effluents, preparation of culture media and tests of bacteria, description of the several organisms found and isolated during the work and the action of waste waters from the milk industry on cement products have also been added. The illustrations given are beautiful and instructive.

The work will no doubt be of immense and constant use not only to persons working in this specialized branch of biochemistry but also to those who are interested in the dairying industry in general. In this connection, the ready co-operation given by the British dairy industry by contributing a sum of £12,000 towards the cost of the investigation is really praiseworthy considering the fact that the work was mainly devoted to lessening the nuisance value of dairy wastes and not for increasing the sources of profit to the industry. Such an example is well worth emulating by the Indian dairy industry.—Z.R.K.

FOOD POSITION OF THE MARATHI-SPEAKING AREA

By N. G. Apte, B.Ag., M.Sc. (Samartha Bharat press, 41, Budhawar Peth, Poona 2., pp.14, Re. 1).

THIS is a preliminary note on the food position of the Marathi-speaking area comprising Bombay city and suburbs, the three districts of Konkan, eight districts of Bombay Presidency, four districts of the Central Provinces, five districts of the Berar and seven districts of the Nizam's Dominions. It gives detailed information with regard to the food-grains, vegetables, fruits, milk, fat, fodder and animal requirements of the region. The food position is described as near about self-sufficiently and if the crops produced are utilized properly the position would be sound. Vegetables, milk and milk-yielding animals and fodder are the main deficiencies, and the author pleads for state aid to remove them. The pamphlet stresses the need for a coordinated and balanced programme of the Grow More Food campaign and recommends increased cultivation of groundnut for human consumption. In view of the importance the question of food has lately acquired, an informative and statistical survey, such as this pamphlet presents, should attract the attention of those interested in the food problem of Marathi-speaking area of India.—B.N.K.

CORRIGENDUM

Indian Farming, Vol. IV, No. 10, Page 537

The cow Phijji whose records are given under the heading 'The 10,000 lb. Milk Club of India' is a Tharparkar cow bred at the agricultural sub-station (at Karnal) of the I. A. R. I. and not a Sahiwal cow bred at the main Institute at New Delhi as stated in the opening sentence.

From All Quarters

REGULATOR OF BONE GROWTH

ALTHOUGH many new vitamins have come to light in recent years, there has been but little progress in discovering why these substances are essential for healthy life and, in particular, what special function each performs in the body. Any new knowledge, therefore, which relates a particular vitamin to the part it plays in the body is a matter of great interest. Such information may lead to the control of a disease. In addition it opens up a new field—often of vast size—for physiological and pathological study.

Recently, a most interesting function performed by vitamin A has come to light through the work of Sir Edward Mellanby. He found that, when young animals, such as puppies, were brought up on diets consisting of ordinary foodstuffs but deficient in vitamin A and carotene, a peculiar deformity in their bones developed, owing to some parts growing at a greater rate than normal. Bones of fine architecture, such as vertebrae, became coarse and all the sharp edges and protusions were blunted and thickened. In the skull, especially at its base, local overgrowth of bone had serious effects, because it actually squeezed and killed some of the nerves as they were passing from the periphery to the brain and destroyed them. In particular, the eighth or auditory nerve was affected by this local bone overgrowth, and the cochlear or hearing part of this nerve was the first to be destroyed, so that the animals became deaf. At a later stage the vestibular division was also destroyed, so that the animals could not recognize the position of their heads in space and their movements became incoordinated and they staggered from side to side when walking or running. Other sensory nerves were liable to be similarly affected, but to a less degree ; for instance, the optic nerve might be destroyed and such animals became blind : the olfactory nerve was nipped and partially destroyed, so that the smelling power of the animals was greatly reduced; and the trigeminal nerve, which is the nerve of sensation of the head also suffered destructive change, owing to bone pressure.

Since the nerve of hearing is particularly affected by vitamin A deficiency, it might be thought that this would afford an explanation of some of the deafness that develops in man. That a deficiency of vitamin A in infants and young children will cause overgrowth of bone of a similar nature is undoubted, but there is no evidence at present to suggest that this is a common cause of deafness in children in Great Britain, probably because the degree of deficiency in amount and duration necessary for its production is rare.

The importance of these observations lies in their scientific interest, because it now appears that vitamin A, instead of stimulating growth, so that growth ceases in its absence, is actually responsible for restraining and coordinating growth of bone. When the brake is taken off by removing this vitamin from the body, growth of bone is too active at some points, and so different parts of the central nervous system are squeezed. In other words, the remarkable co-ordinating mechanism, which allows the skull and other bones to adapt themselves to the size of the growing brain and spinal cord, breaks down in vitamin A deficiency.

In view of the close association in distribution of vitamins A and D in nature, as seen in egg yolk, milk and animal and fish fats, and remembering that the function of vitamin D is to promote calcification or hardening of growing bone, it is a matter of some interest to realize, as we do now, that one important function of vitamin A is also closely concerned with the mechanism of growth of bone, thereby regulating its shape. Thus, cod liver oil, which is a rich source of both vitamins not only causes the production of hard bones but ensures beautifully constructed bones of the right shape and size.—*Monthly Science News.*

HOLSTEIN-FRIESIAN HERD

THE Holstein-Friesian herd at the University of Delaware Agricultural Experiment Station is descended from 17 purebred foundation cows. Six proved bulls were used: and dam-daughter comparisons on milk production, fat percentages and total fat production, based in most cases on advanced registry

tests, showed material differences in their capacity to improve the herd. Descriptions of the conformation of the progeny of the bulls are given. Inspection of the female lines of descent showed that only a few of the cows that were satisfactory milk producers were also satisfactory transmitting dams. In 1940, after 20 years, all the females in the herd could be traced to six cows in the foundation herd. Fifty-eight per cent. of the females in 1940 could be traced to a single foundation cow. This was largely due to the cow being a regular breeder, staying in the herd for a long time, and producing a large number of heifer calves. Her daughters were above the herd average in production, long-lived, and regular breeders. The authors conclude that hereditary factors tending towards low production have been practically eliminated from the germ plasm of the herd.—K. L. B., *Dairy Science Abstracts*, November, 1942.

SEED DRILL FOR JOWAR

THE *tifan* (fig. 1) is three-tined and the *argada* may be four or five-tined. In the case of the *tifan*, one sower drops the seed in a bowl or *chada*, which equally distributes it to three tubes resting on the tines and three lines are sown. In case of the *argada*, no *chada* is provided. In place of the *chada* a *sarta* is tied to each tine and a woman holds it upright and drops the seed. Thus this requires as many woman coolies as their are tines to the *argada*.

The *argada* (fig. 2) is preferred to the *tifan* for *jowar* sowing for the following reasons :

1. *Jowar* is sown after cotton sowing is over. At that time there is plenty of moisture on the surface of the soil and it is not necessary to drop the seed as deep as it is dropped by the *tifan*.

2. There is always choking of the *tifan* in heavy soil, as is obtained in Shirala village, in the Central Provinces while the *sartas* are least likely to get choked.

3. The *tifan* requires very careful adjustment to obtain uniform distribution of seed in all the three lines sown, while the *argada* is a very much simpler drill.

4. Though slightly more expensive as regards the human labour required, it hastens the sowing operations, which are often interfered with by rains. The *argada* covers the area more quickly.

Tifans and *argadas* are prepared by the village carpenters as required. They are not stocked for sale.

The *argada* consists of a main wooden body AB 4 ft. 8 in. long, 6 in. wide and 4 in. thick. The width in the centre of the body is 8 in. to provide space for a handle C.

Four or *five* tines are attached at the lower portion of the body 15 in. apart. The entire length of the tine is 1 ft. 5 in. It is set in the body hole at an angle of 60°. The tine is 2 ft. × 2 in. made out of *babul* wood. The lower pointed end is provided with an iron shoe D to prevent wearing.

A wooden beam split into two is attached to the main body as shown in the sketch. It is split to provide two attachments and better balancing of the drill. It is 3 in. to 4 in. in diameter. The thicker end is attached to the body and the thinner end 8 ft. to 9 ft. is the yoke end.

A *sarta* is a hollow piece of bamboo 3½ ft. long. The upper end is split and widened by means of a string and the lower one is pointed, as shown in the sketch. The *sartas* are attached to the tines by ropes. These ropes are of different lengths. If they were all of the same length the sowers would have to walk abreast and would not have sufficient elbow room.—R. N. DUBE, *Extra Assistant Director of Agriculture, Amraoti, Central Provinces and Berar.*

Four tined argada for Jowar sowing

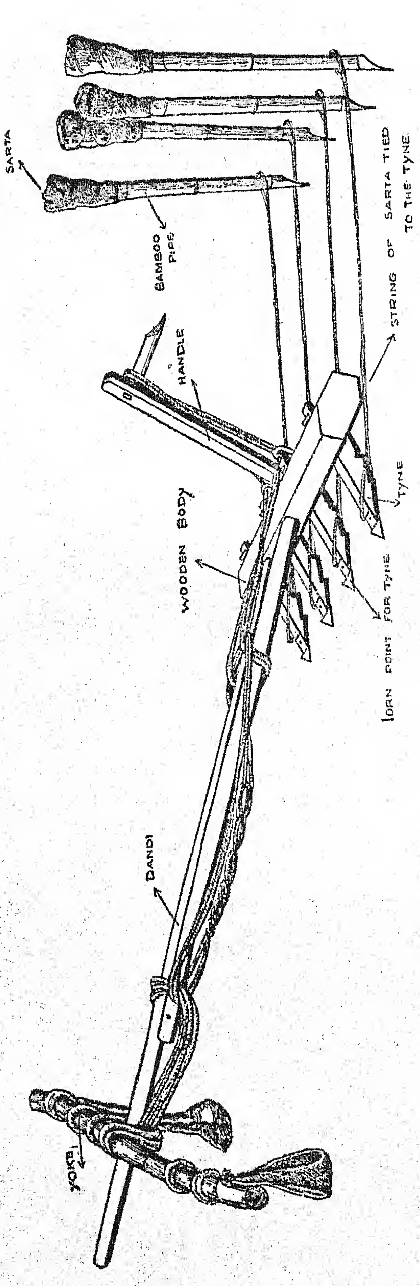


FIG. 1.

'Tifan'—A three tined seed drill

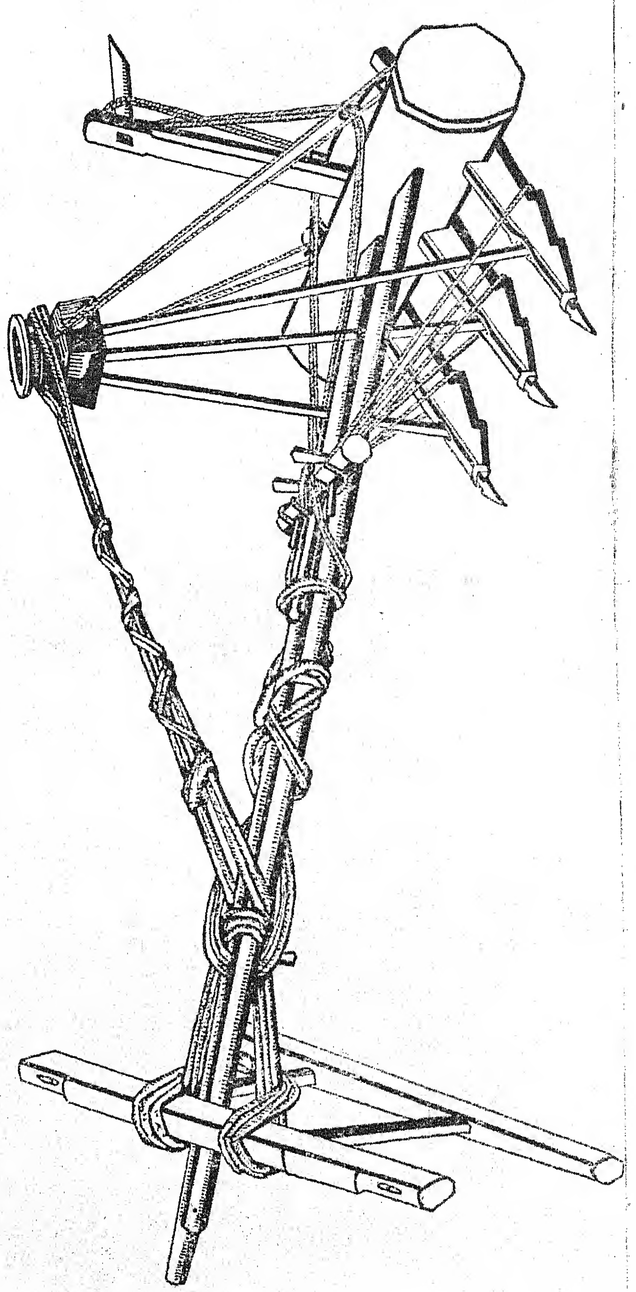
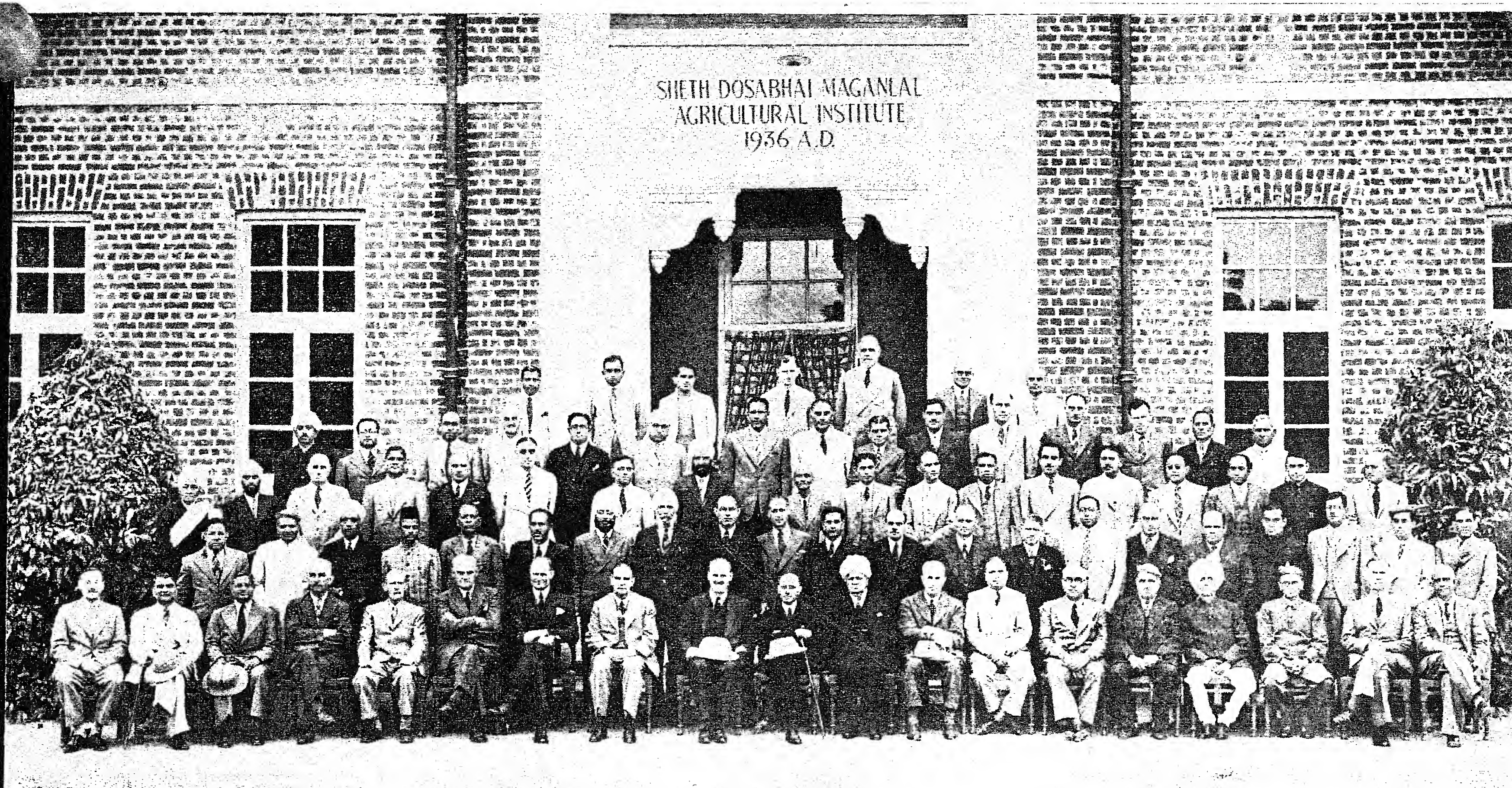


FIG. 2.



BOARD OF AGRICULTURE AND ANIMAL HUSBANDRY IN INDIA, CROPS AND SOILS WING MEETING, NOVEMBER 1943

1st row—standing (from left to right): Mr Shah, Dr V. H. Patil, Dr N. M. Patil, Mr A. R. Thomas, Mr E. F. Sykes, Mr C. V. Sane.

2nd row—standing : Mr S. S. Bhat, Mr F. M. de Mello, Dr J. S. Patil, Mr M. Vaugh, Mr Bhat, Mr Bhate, Dr Chandra, Mr C. Ramaswamy Nayudu Dr Mehta, Mr S. Imam, Mr L. F. Cocks, Mr M. P. Fletcher, Dr G. W. Padwick, Mr G. Govande, Mr R. S. Patil.

3rd row—standing : Mr D. Y. Deshpande, S. Shamsher Singh, Mr C. H. Parr, R. B. Dr D. V. Bal, R. S. K. D. Sawhney, Mr Aquino, Dr R. D. Rege, S. B. S. Labh Singh, Mr Kulkarni, Mr G. R. Sontakay, Mr A. Majeed, Mr R. B. Ekbote, Mr Allah Bachayo Khan, Dr H. Chandhi, Mr S. C. Roy, Dr H. K. Nandi, Mr Dixit, Mr D. N. Mehta.

4th row—standing : Mr P. V. Isaac, Dr Pagar, Dr L. S. Doraswami, Mr B. V. Venkatachari, Mr K. S. Pillai, Mr Zafar Ali Khan, Dr H. S. Pruthi, S. S. S. Kartar Singh, Dr Khan A. Rahman, Mr Habibullah Khan, Dr R. H. Siddiqui, Dr K. N. Trehan, Dr S. P. Aiyar, Mr M. I. Shah, Mr B. P. Akhaury, Dr S. V. Desai, Dr E. S. Narayan, Mr Majid Ali, Mr R. D. Bose, Mr Jadhav, Mr B. Sahay (Secretary).

PLATE 5

5th row—sitting : Major Bazelgate, Mr C. Mayadas, Mr R. G. Sarauja, Mr Roger Thomas, Mr R. G. Allan, Sir William Roberts, Major Hailey, Mr H. R. Stewart, Mr L. W. Jardine, Sir P. M. Kharegat (Chairman), Sir V. T. Krishnamchari, Mr F. Ware, Mr B. A. Gaekwar, Mr D. R. Sethi, Mr N. Patil, Mr B. V. Jadhav, Mr M. B. Desai, *Lt.-Col. C. A. Maclean*, R. B. B. Viswanath.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V FEBRUARY 1944 No. 2

RECOMMENDATIONS OF THE CROPS AND SOILS WING

PROBLEMS related to the most pressing agricultural requirements of the times were suitably reflected in the agenda of the Third Session of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India, held recently at Baroda. At present, when the demand for agricultural products is so imperative, no subjects could be more appropriate or of greater importance than a consideration of the maximum technical potential of different regions for the production of agricultural commodities, the scope of increasing production of those commodities, by collective or joint farming and the problem of protecting stored grains from the ravages caused at present by a number of destructive insect pests.

Agricultural research in India has valuable achievements to its credit, and, though many of its practical results are being used in agricultural practice today, production could be vastly increased beyond its present limits, if fuller advantage were taken of them. But, whilst under existing conditions a considerable and immediate increase is possible, the Board found that the maximum potential in each region can be attained only after much spadework has prepared the way. Nation-wide regional surveys are required of the latent water resources of particular regions and comprehensive plans must be prepared and executed for the maximum utilization of such water for irrigation and for the generation of hydroelectric power : widespread action must be taken throughout the country to ensure that the land available for cultivation is properly drained, levelled, terraced or bunded, as the case may be, in order that maximum use may be made of soil moisture and that soil erosion may be prevented : manures, and in particular sulphate of ammonia, should be produced in India and must be available at cheap rates : improved implements suitable for local conditions must be produced cheaply and maintained in proper repair : more seed farms must be established for the production of adequate supplies of improved seeds of guaranteed germination, capacity and purity : insecticides and fungicides to protect crops and agricultural products from the ravages of pests diseases should be produced in India and must be made available at cheap rates. Finally, more research is necessary under the soil-climate complex of different regions before Agricultural Departments will be in a position to draw up schedules of cultivation on the basis of which it can be authoritatively stated that cultivators will obtain the maximum returns from their land.

Opinions differ markedly in regard to the feasibility of collective or joint farming of the Russian type under Indian conditions, but practice has proved that consolidated farming, or the uniting of a number of cultivators to grow individual crops in large blocks, as opposed to scattered fields, saves labour and increases production through such means as timely sowing, timely tillage operations, more economical use of irrigation supplies and better control of common pests and diseases. The Board recommended the introduction of consolidated farming of this type in villages.

An unique scheme, which came under discussion, was the Baroda proposal to rehabilitate villages whose lands have fallen into the hands of moneylenders and, at the same time, to gain experience of the possibilities and comparative economics of different types of farming. The State proposes to buy back five villages, each of about 1,000 acres, from the moneylenders and to reinstate the dispossessed cultivators under different conditions in each village. The land of all the villages must be farmed according

to a programme fixed by the Centre. In the first village, each cultivator will be given a consolidated holding, which he cannot subdivide. He will pay land revenue at four or five times the normal rate, the excess being credited towards his ultimate purchase of his holding after seven or eight years. The second village will consist of similar holdings, except that the cultivator will always remain a tenant of the State, with security of tenure. He will pay double the land revenue, the excess in this case being retained by the State against the cost of improvements made and facilities granted by it. In the third village, holdings will not be consolidated, but the cultivators will farm by a system of growing crops in consolidated blocks. The fourth village will provide for collective farming, in which the labour will be performed jointly by the villagers, who will be paid from the total produce in the ratio of the labour contributed by each. State farming will be done in the fifth village, the villagers being paid a monthly wage with a final share of the profit at the end of the year. This experiment will provide data of great value, as it will show the possibilities of which agriculture is capable, when land is farmed under different systems, in holdings of economic size and under intensive technical guidance and control.

Power-farming, except for special purposes, also has its adherents and opponents. To many, the possibility of adopting power-cultivation under ordinary village conditions in the more densely populated areas, without disturbing the individual possession of the land, is open to doubt, and the Board recommended that both its possibilities and its effect on crop yields should be explored under these conditions. In newly colonized and freshly developed land and in areas, where the population density is relatively low, the same conditions do not arise, and here the Board advocated power-farming, but emphasized the need to set up within easy reach 'Tractor Stations', which would undertake prompt repairs, provide replacements and hire out machinery for specific purposes.

Discussion on the storage of agricultural products brought out strikingly the inadequacy of existing knowledge of storage methods and means of control most suitable to protect either the small cultivator or the large trader from the heavy loss which insect pests cause him annually to incur on his grains during storage. The recommendations of the Board were concerned chiefly with a statement of the directions in which future research and study in this connection should lie. Meantime, present knowledge should be valuably augmented in the near future by the investigations now actively proceeding in several provinces in India through the coordinated scheme, which the Imperial Council of Agricultural Research originated and financed, to determine the best means of controlling the various pests of principal foodgrains and oilseeds during storage.

The Baroda meeting of the Crops and Soils Wing of the Board will be remembered not only because of the valuable exchange of ideas on matters of immense importance today and the pooling of knowledge and experience by the administrators, scientists and practical farmers, who attended it, but also because it afforded an opportunity for the delegates from all parts of India to see at first hand something of the results of the progressive agricultural policy adopted by this State in recent years. Still less will this meeting be forgotten for the efficiency of the State arrangements in every matter connected with it, for the bounteous hospitality extended by the State to all attending it and for the thoroughness with which every detail likely to affect the enjoyment, convenience and comfort of every individual delegate was foreseen and provided for.

P. E. LANDER

M.A., D.Sc., I.A.S.

An Appreciation

THE departure on leave preparatory to retirement of Dr P. E. Lander has reduced still further that rapidly diminishing band of officers recruited by the Secretary of State to the Indian Agricultural Service prior to 1923.

Born in Cambridge in 1889, he received his early education at the Cambridge and County School. In 1907, he entered Downing College, where he was elected to a studentship in 1908 and to a foundation scholarship in 1909. He

P. E. Lander, M.A., D.Sc., I.A.S.

PLATE 6

to a
first
cons
divic
five
credi
hold
villa
that
of th
pay
case
cost
by it
cons
a sy
bloc
colle
perf
paid
labo
will
bein
the
men
show
capa
syst
inte

P
also
the
und
dens
the
doub
its
shou
newl
in a
tivel
and

T

of o
to th

obtained in 1910 the degree of B.A. with first class honours in the Natural Sciences Tripos.

Originally intending to take up the teaching profession, he entered, during his years at Cambridge, the Cambridge University Training College for School Masters, and in December 1909 took a first class in the Cambridge Diploma of Education.

After leaving Cambridge, he was appointed Lecturer in Chemistry at St Mark's College, Chelsea, a college for training school masters. At the same time, he started research in biochemistry in the physiological laboratories of London University under the late Professor A. D. Waller, M.D., F.R.S. He resigned this post in 1912 on being awarded the Lindley research scholarship of London University in biochemistry. During 1913-14, he toured extensively in India. In 1914, he obtained the Cambridge degree of M.A. and in 1915 was awarded the D.Sc. degree of London University for his thesis, *On the Origin, Destiny and Functions of Cholesterol in the Animal Organism.* He was elected a Fellow of the Royal Institute Chemistry in 1929.

In August 1914, immediately on the outbreak of the Great War, Dr Lander was commissioned in the Royal Fusiliers, City of London Regiment, but in 1915 he was transferred to the R.A.M.C. as a specialist officer. Early in the following year, he was sent to East Africa in charge of an independent section for general health and sanitary work in the field. He served in the East African campaign till the end of 1917, and was mentioned in despatches. Finally, he served on the Western Front in France in a similar capacity till June 1919.

In 1920, he was offered the Chair of Chemistry in Hong Kong University, but he preferred to accept an appointment in the Indian Agricultural Service and arrived in India in December of that year. He was posted to the Punjab Agricultural College at Lyallpur as Agricultural Chemist to the Government of the Punjab—a post which he held till the date of retirement.

When Dr Lander began his career at Lyallpur in 1920, the Chemical Section, of which he was in charge, dealt essentially with soil and crop chemistry Particular attention had been paid by his immediate predecessors to the reclamation of alkali soils—a subject on which very little was then known. Although continuing that work and building up a strong soil research section, at the head of which a Second Agricultural Chemist was appointed a few years later, Dr Lander's chemical interests were primarily concerned with animal nutrition problems. Little or no work had been done in India up to that time on this subject, and few facilities existed anywhere for such work. Dr Lander therefore set himself to build up a specialized nutrition section at Lyallpur and, in the 20 years which followed, that section grew steadily both in size and importance. Today, it is known throughout India and its valuable scientific publications will be of use to all interested in animal nutrition problems for many years to come.

In addition to his charge of the section of agricultural chemistry at Lyallpur, he acted on various occasions for a total of some six years as Principal of the Punjab Agricultural College. Under his administration, the College prospered, and many extensions and improvements took place. It is, however, as a pioneer in animal nutrition research in India that Dr Lander will always be remembered. By his retirement, India has lost one of its earliest pioneers in this line. His last and greatest contribution to the literature on animal nutrition in India was the preparation for the Imperial Council of Agricultural Research of a most valuable monograph on the feeding of farm animals in India. This monograph covers the whole range of animal nutrition. It embodies the research on it up to date, including Dr Lander's own, and is the first work of its kind to be produced in India.

Original Articles

PRAWN FISHERIES OF INDIA[1]

By B. N. Chopra
Zoological Survey of India, Kaiser Castle, Benares Cantonment

PROVISION of food has always been a major problem with man and has acquired special importance in these days of international struggle. As a result of the Grow More Food campaign hundreds of thousands of additional acres are being brought under cultivation but simultaneously with this efforts should be made to make available large supplies of fish of all kinds in a wholesome condition and at cheap rates. Next to agriculture and perhaps animal husbandry, fishing is the biggest industry of our country, and provides employment and sustenance to lakhs of people. Prawns are a very important part of our fisheries and in some markets at least are more important than any other kind of fish.

Commercial prawns

The most important of our commercial prawns are the Penaeids, or what are known in trade circles as sea prawns. These live mostly in the sea, backwaters, lagoons and estuaries, though some species occur in waters that are even quite fresh for considerable parts of the year. Some Penaeids grow to about a foot in length, excluding the claws, while others are barely two or three inches long. Large quantities of these are fished in the deltaic region of Bengal, in the Chilka Lake in Orissa, along both the coasts of Madras, in the backwaters of Cochin and Travancore and along the coast of Bombay and Sind.

The freshwater prawns or the Palaemons are also of great importance in several parts of India. These are essentially freshwater animals, but some live in brackish waters also and a few can even tolerate sea water for considerable periods. The largest among these attains an overall length of almost 2½ ft. (including the greatly enlarged claws of the male) and a single specimen may weigh well over a pound. Palaemons are extensively fished in the lower reaches of rivers, lakes, *jheels*, tanks, etc. in several parts of India.

Some of the smaller forms of different families, commonly known as shrimps, are also of great economic importance. They rarely exceed an inch in length, but the smallness of their size is more than made up by the vast numbers in which they occur. Many of them live in shoals near the shore and in estuaries and backwaters, where they are ravenously fed upon by several of our edible shoal fishes.

There are flourishing prawn-fisheries in several centres in the Gangetic delta in Bengal. Large quantities of prawns are consumed fresh near the fishing centres, equally large quantities are sent inland, sometimes packed in ice, and the surplus, which is often very considerable is dried. In several districts, notably in Khulna and Bakarganj, there is a large dry-prawn industry. Prawns are sun-dried or smoked or boiled and sun-dried and approximately 300,000 md. are manufactured every year. Dry prawns fetch a high price, ranging between Rs. 5 and Rs. 25 per md. varying with the process of manufacture and the season of the year. Profits must be quite substantial in this industry, as the manufacturer can generally get the raw prawns at anything between 12 as. and Re. 1 per md. and all the different processes of manufacture are comparatively inexpensive. Further, it may be stated that prawns, which the poor fisherman is forced to sell at 12 as. to Re. 1 per md. at the fishing centre, are sold in the Calcutta market at between Rs. 10 and Rs. 20 per md.

Advance in Madras

The Government of Madras, with its very efficient Fisheries Department, has long been alive to the necessity of developing the fishing industry along up-to-date scientific lines. Several notable advances in fishery practices have been made, but only two, the curing and canning of prawns, may be mentioned here. The common and universal method of curing

[1] Summary of the presidential address of Dr B. N. Chopra, Zoological Survey of India, to the section of Zoology and Entomology of the Indian Science Congress held at Calcutta in the first week of January 1943.

prawns in the province had been of simply strewing the prawns, wholly unsalted, on the beach to dry. The resulting product was always badly tainted and unsatisfactory in many ways. At the Tanur Experimental Station on the West Coast a very successful method of curing and semi-drying prawns has been devised ; the product is suitable for the best tables, and when packed in carbon dioxide gas, as is being done now, keeps in perfect condition for months. An experimental cannery was established at Calicut and later shifted to Chaliyam. This proved a great success right from the beginning and a large demand was set up for its products. The marketing organization was perhaps faulty and for this and other reasons the cannery has had to be closed down, but it has definitely shown that the canning of fish and prawns can be successfully done in India. The Madras Fisheries Department has also been publishing for several years very useful fish statistics, the need of which has always been keenly felt in India. For one thing these show the importance of prawns in the fishing industry ; in the town of Madras, for instance, both in quantity and value prawns are of greater importance than any other kind of fish. The statistics also show that prawns, for which the fisherman at some of the curing yards on the West Coast sometimes gets only 4 as. 10 pies per md. are being retailed at Madras at prices higher than Rs. 11-8 per md.

In certain parts of the backwaters of Cochin and Travancore prawns are cultured. Young prawns are let into enclosed fields adjoining the backwaters, are allowed to grow there and are fished in enormous quantities when they have attained a marketable size.

In addition to the extensive prawn fisheries along the Bombay and Sind coasts, there is a small-scale fishing for spiny lobsters in Bombay. There is a flourishing dry-prawn industry in these provinces.

Primitive methods

The Indian prawn fisheries in general are in a very backward condition. The fisherman is still employing very primitive methods, for very little, if any, improvement has been made in his gear or in his stock of knowledge since the time of his forefathers. For generations he has been in the grip of a ring of money-lenders, and is forced to sell his catch to them, sometimes at ridiculously low prices. The handling of the catch is equally unsatisfactory. Drying is done on a large scale, but generally in a very primitive way, and results in a product which is far from satisfactory.

In many other countries of the world great advances have been brought about in fishery practices as a result of scientific and technological researches. There is an urgent need for similar researches in India also. The catches which the Indian fisherman is able to get with his simple appliances generally compare favourably with those of the more advanced countries, and the real problem is not so much the production of more fish though that is a very desirable object, but the proper preservation, distribution and utilization of such fish as are available. Quick-freezing refrigerators, cold storage, speedy transport and better distribution, besides helping to raise the economic condition of our fishermen, would make this valuable food available to our people in adequate quantities and at cheap prices. Better sale organizations are badly needed. In Bengal, it is stated, there are invariably three intervening middlemen and one retailer before the fish reaches the consumer. Sun drying, the commonest method in vogue, is wasteful and at best results in a very unsatisfactory product. The Tanur method of curing should be popularized and smoking and boiling also encouraged. Artificial driers should be installed to make the manufacturers independent of weather conditions and thus stop large-scale wastage. Canning should be taken up on a wide scale and to make this popular model canneries, under Government auspices and staffed by trained technologists, biochemists and marketing experts should be started in a number of selected centres as soon as conditions become favourable. Improvement of fishing craft and fishing gear should be urgently attended to, and the amelioration of the lot of the fishermen should be given a very high place in our scheme of fishery development.

CONSERVATION OF SOIL MOISTURE UNDER DRY FARMING

By Sukh Dayal Nijhawan, B.Sc. (Hons.), M.Sc.
Soil Physicist, Dry Farming Research Station, Rohtak, Punjab

UNDER dry farming conditions water is the limiting factor for crop production, and therefore the primary problem of dry farming is the most effective storage in the soil of the rainfall. Only the water safely stored in the soil and within easy reach of the roots of the crops is useful for raising crops. Crop failure or success depends largely on the methods used for the retention of rainwater in the soil. Therefore every attempt should be made to preserve every drop of rain. This problem has been studied at the Punjab Dry Farming Research Station, Rohtak, for the last seven years and the methods found successful are dealt with here.

Absorption of rainwater

The water falling on a field is absorbed by the soil, and then it slowly descends to the lower layers. The maximum amount of water which can be absorbed depends on the condition of the soil at the time of rainfall. In well-ploughed land with a loose spongy soil at the top, the rainwater is readily absorbed and thus most of it escapes the effect of sunshine and wind. In a cultivated or ploughed land there is about 2 to 4 per cent more absorption of rainwater in a 6 ft. column of soil, depending on its texture. In uncultivated land water remains for a longer time on the soil surface and thus most of it is lost by evaporation. Evaporation from a free water surface is three to four times more than from moist soil and thus water held up in the soil is lost slowly. In order to effect maximum absorption of rainwater the land should be cultivated with a plough as soon as possible after harvesting a crop. For medium or light loams cultivation can be done with the country plough, but for a heavy soil it would be advantageous to use any of the inversion ploughs, Raja or Hindustan. Inversion ploughs may also be used if the field is full of weeds (Plate 7, figs. 2 and 3).

Soil mulch

A layer of loose dry soil on the soil surface formed by cultivation is known as soil mulch (Plate 7, fig. 1). There is a belief that by the formation of a loose dry mulch on the soil surface, it is possible to reduce greatly the loss of soil moisture by evaporation. Recently, however, there has been a great controversy about this among the scientists. Experiments conducted by some workers support the idea that mulch does conserve moisture; while others have shown that soil mulch does not help in the conservation of soil moisture. However, the work carried out at this station has shown that mulch does conserve moisture though it has a limited effect. A 3 in. to 4 in. thick layer of loose dry soil is most effective in minimizing the evaporation of soil moisture. By forming soil mulch it is possible to save 35 to 80 tons of water in a 3 ft. deep layer of an acre field. Though in a mulched plot there is more of moisture throughout the 3 ft. layer of soil, the differences are significantly greater in the upper 1 ft. The first 6 in. layer of a mulched field contains more moisture than that of an unmulched one. This increase in moisture is useful for sowing *rabi* crops. In the south-eastern Punjab rains generally stop by the middle of September and in order to get good germination of the *rabi* crops, it is advisable to sow in the third week of October when the soil and atmospheric temperature, suitable for the germination of these crops, are prevailing. The effect of mulch is seen a fortnight after it has been formed and it remains for a period ranging from 30 to 60 days depending on the type of soil and seasonal conditions. Mulching is more effective on a heavy soil than on a light one. Some loamy soils are self-mulching, i.e. under arid conditions the top soil dries up quickly and thus forms a natural soil mulch on the surface. For forming soil mulch it is necessary to cultivate the field after each heavy shower of rain. But it is not always necessary to cultivate the land with a plough; any of the hoes can be used. Lyallpur hoe has been found to be very suitable for the purpose. The stand of barley crop in the mulched and unmulched is shown in fig. 1. Mulched plots have always given more yields of gram and barley.

YIELD IN LB. PER ACRE

	Gram		Barley	
	Grain	Straw	Grain	Straw
Mulched	880	1046	915	839
Unmulched	397	496	252	264

Artificial mulches

Besides soil mulch artificial mulches can be efficaciously used for the conservation of soil moisture. The land should be covered with any kind of vegetable, sand or paper debris. At this station experiments have been conducted with cotton stalks, *bajra* and guara straw and sand. About 3 in. thick layer of vegetable trash or 2 in. layer of sand has brought about the maximum conservation. Vegetable debris may be spread over the land before the break of the monsoon. As, in this season, the winds blow with great intensity it is feared that the vegetable debris may be blown away ; in that case it can be spread immediately after the first shower of rain. There are heavy losses of soil moisture immediately after the soil is irrigated or becomes wet with rains and more than 60 per cent of moisture is lost before the soil is fit for cultivation and soil mulch can be formed. Thus the artificial mulch conserves more water than the soil mulch as the former saves the water lost during the period the soil is wet and unsuitable for the formation of soil mulch. Sand conserves moisture better than even vegetable trash, and it is due to this that even with a small amount of rains a good crop is obtained in the soils covered with a layer of sand. Such soils are found in Hissar district where medium loam soils have been covered with sand by the storms which generally blow in this area. No experiments have been conducted with paper mulch but these have been used in America with some success. Like the soil mulch artificial mulche is more effective on a heavy soil than on a light one. Under a layer of artificial mulch there is more moisture and it remains for a longer period as compared to soil mulch.

Eradication of weeds

Weeds which generally sprout up in the fields, cause heavy loss of moisture. Each plant acts as a pump and the deep-seated moisture which remains unaffected by the scorching heat of summer is pumped out into the surrounding atmosphere by these tiny plants and thus a very large amount of moisture is lost. Weeds greatly desiccate the soil of its moisture and though their growth above ground is very little their roots go very deep into the soil. Observations show that in a weedy field no moisture is available even to a depth of 6 ft. and no crop can grow. The distribution of moisture in a plot with weeds and from which weeds were removed is given below :

MOISTURE PEE CENT ON OVEN DRY SOIL

	0-6 in.	6-12 in.	2 ft.	3 ft.	4 ft.	5 ft.	6 ft.
Weeds removed	3·55	7·86	12·44	13·11	12·58	10·77	8·22
Weeds standing	1·54	4·71	6·49	7·71	7·64	5·15	3·50

The results of several trials conclusively show that it is possible to save 300 to 500 tons of water in an acre of soil to 6 ft. depth by keeping it free of weeds. This gain is equal to 3 to 5 in. of rain water and it is sufficient to produce about 500 to 1000 lb. of crop. It is therefore necessary to keep the land free of weeds under dry farming conditions. No extra labour is involved in keeping the land free of weeds. Weed eradication is incidental to mulch formation, as the cultivation done to form soil mulch can also keep down the growth of weeds (Plate 7, fig. 4).

Fallowing

The rainwater moves in the soil to a considerable depth (10 ft.) and during a rainless period water evaporates from the first 2 ft. but even here 75 per cent of the total water lost by evaporation comes from the surface foot layer of the soil. The moisture in the lower layers remains unaffected and can be carried from year to year. if it is not consumed by weeds or the crops sown. If rains during a season are insufficient to mature a crop, it is still possible to raise it on the combined rains of two seasons, though in both the years the rainfall may be scanty. Under dry farming conditions crop growth depends entirely on rainwater, and as the rainfall is low and erratic in distribution in such areas, famine conditions are common features of the tract. Under such conditions, it is not judicious on the part of the cultivator, if he puts, as he does always, the whole of his holding under crop year after year. In a year of good rainfall, which is rare, he gets a moderate crop, in others he gets nothing. Instead of putting the whole of one's holding under a crop, a portion of it should be left fallow and in this portion one crop may be raised in two years

or three crops in two years. By following this practice it has been possible at this research station to get some fodder and grain even during the years when the crop on cultivators' fields had failed totally.

Yields of *bajra* and Guara (*Cyamopsis psoralioedes*) from fallow plots during the years of scanty rainfall are given below :

YIELD IN LB. PER ACRE

	Bajra Grain	Bajra Straw	Guara Grain
Fallowing ..	923	4480	214
No Fallowing ..	358	2959	26

Bunding

It is essential that rainwater is uniformly distributed over a field. By dividing the field into small compartments rainwater can be distributed. For this purpose an acre may be divided into five parts by means of small bunds, 6 to 8 in. high. It is advisable that the bunds should approximately run along the contour of the field. If the field is not divided into small compartments the water runs into depressions and a major area of the field does not get sufficient moisture to support a normal crop. Besides, the water which flows into depressions also takes away with it a considerable amount of silt and clay and deposits it in the depressions, and thus impoverishes a major portion of the field of its essential food material. The soil in the depressions becomes poor in structure, as due to the depositing of clay and silt on the surface it becomes impervious, and unfit to support a normal crop, especially legumes. Therefore, by proper bunding it is possible to increase the yields of gram and barley. The yields in lb. per acre of both the crops are given below :

	Gram	Barley
Bunding ..	376	1356
No Bunding ..	266	1044

Application of organic manures

It is not advisable to put in heavy doses of organic manures under dry farming. But small doses of 2½ to 5 tons per acre which have been used here have not shown any effect on the conservation of moisture. Even the addition of a heavy dose of these manures may have no effect under high temperatures, for the added manure is oxidised very quickly. However the application of manure has got an indirect effect. It enables the crop to draw moisture from lower layers of the soil. The crop in the manured plots takes about 20 per cent of its total water requirement from the third foot layer while the crop in the untreated plots does not take any moisture from the third foot layer. The application of manure should only be made to soils low in fertility. If manure is added to a soil of average fertility the crop sown on it puts on luxuriant vegetative growth at the expense of the moisture in the soil. If during the season the rains are scanty the crop in the manured plots is left with less water when compared to unmanured plots and the result is that the grain yield of the crop in the manured plots is lower than that from the unmanured one.

In 1936 when rainfall was above normal the manured plots gave higher yields of grain as well as straw, but in 1939 when rains were scanty the manured plots gave higher yields of straw but there was very little difference in the yield of grain.

YIELD OF BAJRA IN LB. PER ACRE

	1936 Grain	1936 Straw	1939 Grain	1939 Straw
Manured	1942	4392	413	1238
Unmanured	912	4642	397	813

The success or failure of the crop under dry farming depends mainly on the soil moisture, and each pound of rain water conserved means an addition to the yield of the crop. The above operations should be carefully followed in order to bring about the maximum conservation of soil moisture, which is necessarily the accumulative effect of all the factors discussed above. When any one of the above operations is not carried out properly, it will result in lower yield in a season of normal rainfall and total failure of the crop when the rains are scanty.

Conclusions

(1) After the rains the land should be opened with a plough as soon as possible to effect absorption of water. (2) An acre field may be divided into five compartments by means of small bunds. (3) After each shower of rain of half an inch or more, the land should be cultivated with a hoe to eradicate weeds and form soil mulch about 3 in. deep. (4) Application of farmyard manure at the rate of 2½ tons may be made only to the fields low in fertility. (5) A part of the holding should be kept fallow for one rainy season.

G 1. Barley crop Unmulched Mulched

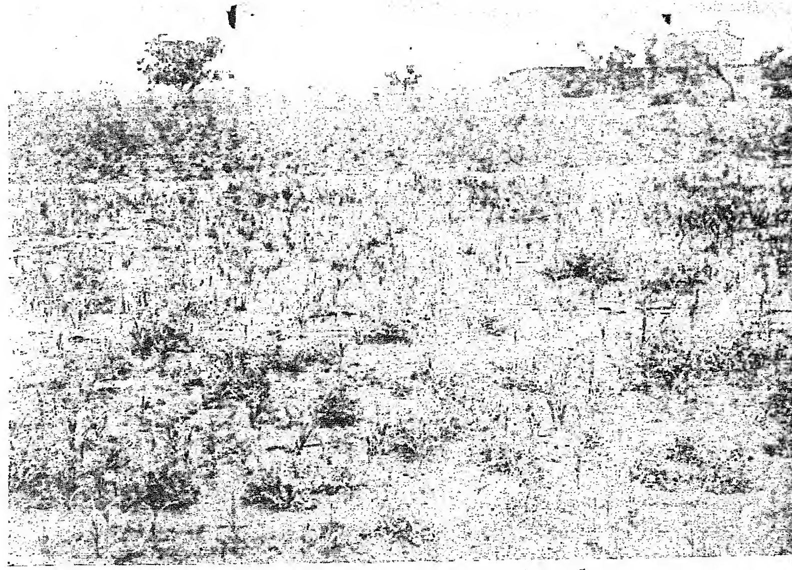
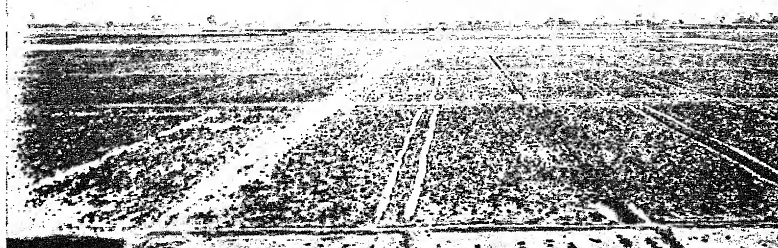


FIG. 2. A field full of weeds

FIG. 3. Uncultivated zemindars' fields

FIG. 4. Cultivated field at the station



PREVENTION OF HOUSE-FLY BREEDING

By P. V. Isaac, B.A., M.Sc. (Lond.), D.I.C., I.A.S.

Second Entomologist (Dipterist), Imperial Agricultural Research Institute, New Delhi

A NEWSPAPER with a very wide circulation in India recently said : 'An article by an investigator and an editorial note in the latest issue of *Leprosy in India*, the quarterly of the Indian Council of the British Empire Leprosy Relief Association, deals with the domestic fly. It has long been under suspicion as a carrier of leprosy. Many investigators have found some evidence that it can act as a disseminator. There is, however, no reason yet to believe that it plays an important part in transmitting the disease. Such evidence on the subject as exists, however, adds yet one further cause to the many previously existing ones for avoiding flies and destroying as many as possible.' The house-fly is a much dreaded enemy of man. Both scientific evidence and general observation that several fatal epidemics among adults and children are associated with the increase in house-fly population have caused the house-fly to be regarded as a source of serious danger to human health. The house-fly's habit is to enter human habitations, feed on man's food, drink animal excrement of all sorts and to breed in dung and garbage. Though the dangerous nature of the house-fly is recognized the campaign against it is quite inadequate at present.

Definition

The popular term house-fly is used for the small two-winged insects that enter houses and visit food, provisions like meat, fish and fruits, and decaying animal and vegetable refuse thrown out. They lick the food they desire to consume, are very active and when driven away frequently come back very soon to the same spot. In India, as in many other tropical countries, there are several species of flies of the genus *Musca*, which go under the popular name of the house-fly. All these are about a quarter of an inch long and mouse-grey in colour. Minute differences in structure and colour mark the different species.

Life-history

All house-flies seem to breed mainly on cow-dung or other animal excrement. Fresh dung is most suitable for their breeding and eggs seem to be laid from about half an hour after the dung has been evacuated to about twenty-four hours later. Eggs hatch and produce maggots ; the maggot when full grown passes through a resting stage when it looks like a seed and is called pupa. Inside the pupal case the maggot develops into a fly which comes out of the case by bursting it open with the aid of a collapsible bladder-like process on its head.

Rapid multiplication

The house-flies breed throughout the year. In early summer these flies take 12 to 14 days to grow into adults from the egg-stage. This developmental period becomes shorter in the hottest part of summer and longer in winter. The adults pair and lay eggs soon after emergence. Multiplication is very rapid and on a large scale, considering that each pair is capable of giving rise to about 150 progeny and fresh broods develop once in every 20 days. Many practices of human society favour them with food, shelter and suitable breeding places.

Carrier of disease germs

The house-fly, both by its habits and structure, is always transmitting disease germs and thus spreading disease among human beings and domestic animals (fig. 1). It is particularly attracted to filth around dwellings and feeds on excrement, vomit, sputum, all sorts of decaying matter and the most carefully prepared human food everywhere whether in hut, barrack, tenement or palace. In passing from one place to another it collects germs and filth all over its body, particularly on the fine hairs around its mouth and on the bristly hairs and sticky pads of its six feet. As it feeds on foul matter its intestinal contents become charged with infective material. The house-fly vomits droplets of liquid on foods like sugar to be able to lick the material. The 'vomits' and the wet fecal matter 'specks' which it frequently voids take with them the infective material previously swallowed. The flies that develop from maggots that have lived in infected media and have taken in certain infective substances go about carrying and distributing the infection.

By accidentally dropping into drinks, especially milk, the flies infect all such liquids. During an inquiry it was found that the number of disease germs on the body of a single fly may range from 800,000 to 500,000,000. Inside its intestines a fly may carry from 10,000 to 330,000,000 germs. As a distributor of germs the house-fly has no other insect to compare with it.

House-flies are known to transmit (1) gastro-intestinal diseases such as typhoid fever and cholera and dysentery ; (2) 'yaws' or tropical ulcer ; (3) ophthalmia ; (4) eggs of parasitic worms; (5) tuberculosis ; (6) anthrax; and (7) tapeworms of fowls. House-flies are according to recent studies strongly suspected as the carriers of the virus of infantile paralysis and of summer diarrhoea of infants.

In warm climates house-flies are most annoying disturbers of rest. Troops have been often troubled and unable to get any rest or even to consume food and drink owing to swarms of flies settling on them.

Prevention of breeding

As has been explained above, the house-fly is the greatest enemy of man's health and comfort in peace time ; and to the soldiers in the field in wartime it can add to other problems with extra intensity the menace of irritation and epidemics. It has already been pointed out that house-flies breed in most accumulations of decaying and fermenting animal and plant substances. The house-fly can fly distances of 10 to 12 miles. That we should allow house-flies to multiply and then make efforts, which are expensive, to kill them is a very unsatisfactory state for our civilization. We should not permit the breeding of house-flies.

For the destruction of house-flies it is necessary to :

(1) take sanitary precautions to prevent flies from entering houses and getting at and contaminating food by fly-proofing with wire gauze all doors and windows and keeping provisions, food and drinks and garbage and excrement inaccessible to them ;

(2) adopt sanitary measures to eliminate as far as possible the breeding places of flies by planned disposal of all refuse ; and

(3) dispose of all household and municipal refuse in such a manner that house-flies cannot breed in them and all immature stages of house-flies in them are destroyed and no adult flies can emerge from them. For this purpose incineration is the only method till now known to be completely effective.

New method for disposal of refuse

As the breeding of house-flies takes place in dumps of cowdung, horsedung, and garbage of all sorts, organized and continuous attempts should be made to prevent such breeding. Except incineration other methods are not quite successful and are expensive. Incineration is often disapproved of as the process destroys material in great demand as manure for raising crops.

Recent investigations by the writer have shown that dung or garbage or other such material in which house-flies are breeding could be buried in such a way that flies could not breed in it and in the case of dung it could retain its manurial value.

Dung is only attractive to house-flies for egg-laying up to about 24 hours after it has been evacuated. Fly maggots can breed in it only during the first few weeks when it is fermenting and warm. The maggots when full-grown leave the feeding ground to get into dry soil near the surface to turn into the pupal stage and then emerge as flies. It generally takes, as has been mentioned above, at least nine days for a fly to develop from egg to adult. The maggots do not like the sunlight or very damp soil. If fresh dung and garbage are filled into deep pits in fairly hard soil, up to a foot below the surface, levelled and is covered up with about a foot of earth applied in three layers, each 4 in. deep, and each 4 in. layer successively rammed down, wetted to about 2 in. depth and pressed down again there is no emergence of flies (figs. 2 and 3). The closing of pits in this manner keeps in the heat due to fermentation in the dung and garbage and raises both the temperature and humidity within the mass so as to kill the trapped maggots. As flies develop from eggs into adults only in about nine days these pits or trenches need be closed up only after seven days. Such pits also act as traps against fly multiplication as during all these seven days when the daily refuse is being put into the pit the decaying refuse is attracting flies to lay eggs in them.

In conclusion a statement by Dr L. O. Howard, perhaps the greatest Economic Entomologist of our time may be quoted here. It runs: 'The truest and simplest way of attacking the fly problem is to prevent them from breeding by the treatment or abolition of all places in which they can breed.'

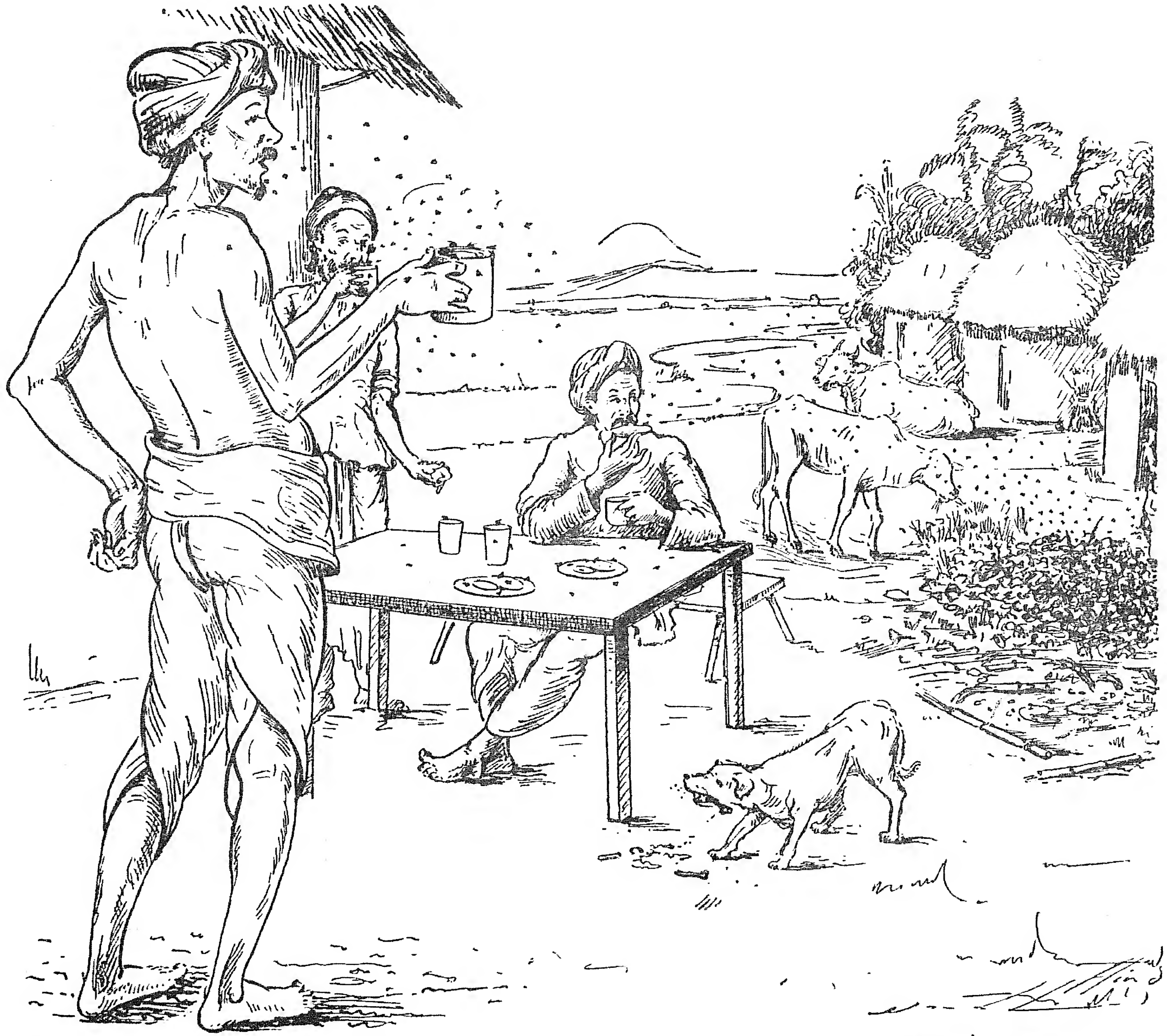


Fig. 1. *The housefly is the cause of the transport of many disease-causing germs from rubbish heaps to the cup and from the cup to the lip.*

PLATE 8

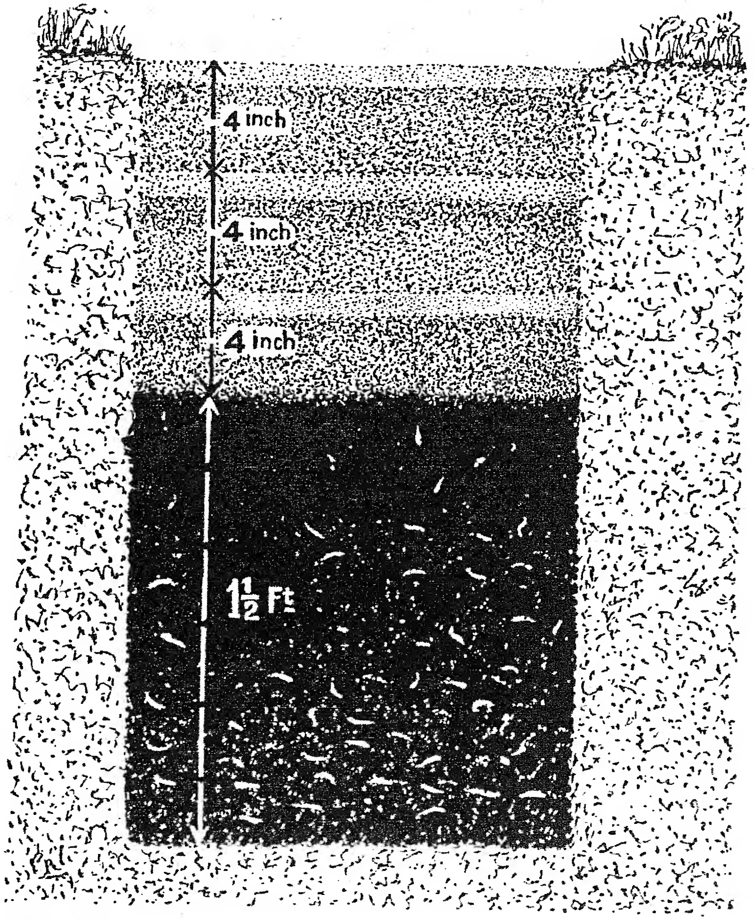


Fig 2. Cross section of dung-pit, covered over with three successive layers of earth, each 4 inches thick and each wetted and plastered down. All maggots are killed.

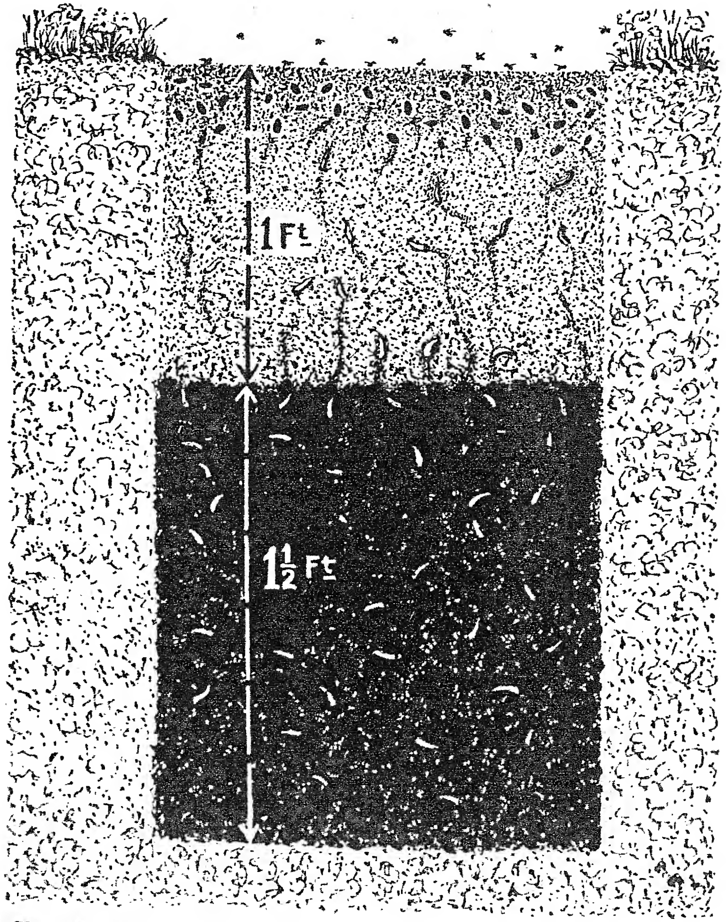


Fig. 3. Cross section of dung-pit, covered over with one foot of earth pressed down. Maggots remain alive and flies come out.

POTATO STORAGE IN POONA

By B. N. Uppal

Plant Pathologist to the Government of Bombay, Poona

STORAGE of potatoes is commonly practised in some parts of Khed taluka and Sirur peta of Poona district, where the summer temperatures range in the neighbourhood of 105°F, but the nights are quite cool (from 42 to 65°F) due to the prevalence of westerly breezes which reach these areas late in the afternoon. Cultivators who store potatoes in these areas are very particular about the quality of the produce to be stored, since the care and treatment given to the crop during its life largely determine its suitability for storage.

Precautions during crop growth

Cultivators who habitually store potatoes are very careful about the irrigation of the crop, which is applied once in 8 to 10 days in the first two months of its life, the interval between irrigations being reduced to 6 days as the crop reaches maturity. It is thus possible by proper and timely irrigations to prevent the cracking of the soil after the tubers are formed, as these turn green on exposure and are also liable to be infected with the tuber moth which lays eggs in the eyes of exposed tubers. There is also a belief among the cultivators that lack of proper irrigation 'heats' the tubers in the soil, and such tubers have poor keeping quality. Earthing up is another operation to which much care is given, as no tuber thus remains without a covering of the soil. The time of harvest is ordinarily determined by withering and general yellowing of the foliage but, if potato tubers are lifted after the haulms have completely died down, it is believed that such tubers do not keep well and begin to rot from the heel end. It is also important that the harvesting of the crop should be done when the soil is in an optimum condition of wetness.

Storage of crop

This is most difficult in practice as the tuber moth, *Phthorimoea operculella*, lays its eggs in the eyes of the tubers after these are lifted. It is, therefore, necessary to protect the heaps of tubers in the field by some covering. Before storage, potatoes should not be allowed to be 'heated' by leaving them exposed to the sun. The storage method commonly practised in Poona district is as follows: A cool place for storage is selected under a cluster of trees near the cultivator's field, the important consideration being that the place should not be exposed to direct sunshine during the hottest part of the day. Wherever such a place is not available, thatched sheds are built under a tree, and the sides of these sheds are left open for 1 to 2 ft. from the ground to allow free circulation of air in the sheds. The land under the trees or the sheds is then laid out into beds, each 4 to 5 ft. wide, the length of the bed depending upon the quantity of potatoes to be stored. It is necessary to emphasize that the width of a bed should not exceed 5 ft., since potatoes heaped in beds of greater widths begin to rot quickly in the centre. Around each bed a water-channel, 6 to 8 in. in depth and 1 to 1½ ft. in width, is dug out, and the earth so excavated is used to make a ridge, about 9 in. in height, all round the bed. The bed is then filled with water and allowed to soak for one or two days. When the bed is sufficiently dry so that the soil does not stick to the tubers, freshly harvested potatoes or selected tubers which have been previously dried are heaped on the bed, usually up to a height of about 4 ft. and are covered with a thin layer of *neem* leaves. The whole heap is then covered with a 6 to 8 in. thick layer of moistened grass, the lower ends of the grass layer falling into the water-channel outside the ridge. The work of covering the heap with grass requires much skill and, if properly done, the grass covering affords an effective obstruction to the entry of the tuber moth, besides keeping the potatoes cool. Several such heaps can be laid side by side. Sometimes small quantities of sugar are scattered on the heap so as to attract ants which feed upon the larvae of the tuber moth.

After the heaps are covered with grass, the only care to be taken is to keep the temperature inside them as low as possible. In ordinary practice this is done by letting water into the channels surrounding the beds, and sprinkling it on the grass once in 3 or 4 days. As water evaporates from the wet grass, heat is lost in

the process, and the temperature inside the heap is thus lowered. Water in the channel soaks into the soil and keeps the ground under the tubers moist and cool. It has been observed that, if the heaps are well managed, the temperature inside them does not ordinarily rise above 85°F. Potatoes stored under such conditions do not sweat but remain dry and cool. It is necessary, however, to ensure that water from the channel does not accumulate in the bed, since potatoes in contact with free water begin to rot quickly.

The heaps are usually not disturbed until the potatoes are finally taken out for sale, but some cultivators open the heaps once during the period of storage and remove all such tubers as show dry or wet rot. Potatoes stored in this way keep well for three months or even longer, and do not suffer much damage from rots.

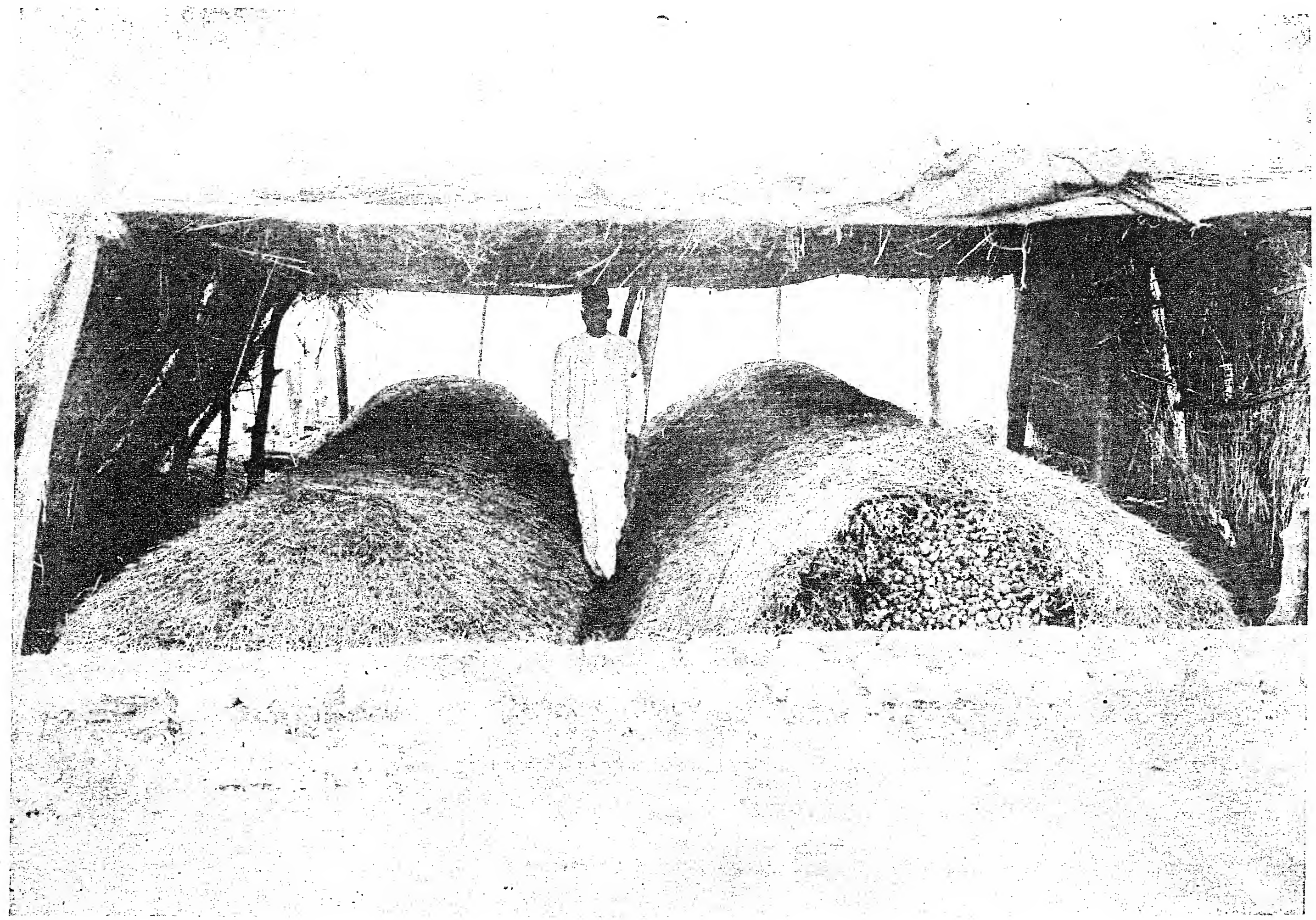
Storage and supply scheme

The method of storage described above was adopted on a commercial scale for storing potatoes from February to June 1943 for supply to the Defence Department in connection with the Potato Storage and Supply (Military) Scheme organized by the Department of Agriculture in Bombay. Storing was done along the main avenues of the Poona Agricultural College and at the Fruit Experiment Station at Kirkee. In all about 200 beds, ordinarily measuring 25 ft. × 6 ft. each, were laid out under the shade of trees. The maximum quantity of potatoes stored in each bed was 100 bags or 200 md. Of 31,750 bags of potatoes purchased for supply to the military, over 25,000 bags were stored, but the maximum period of storage did not ordinarily exceed two months since the whole quantity was not purchased at one time and about 150 bags of potatoes were, on an average, drawn daily by the military authorities from these stores. Considering that potatoes purchased for storage received rough handling and were exposed to the sun and heat during transit from the cultivators' fields to the storage depots, the results of storage exceeded all expectations, since the storage loss was about 5·5 per cent of the total number of bags purchased for military supply. In some heaps, however, potatoes suffered damage to the extent of 8 to 10 per cent, but such heaps were very few and were ordinarily those which were exposed to the sun during the hottest part of the day. It is necessary to state here that about five to six thousand bags of potatoes were not stored but supplied direct to the military but, as these bags have been taken into account in calculating the total loss, the actual loss would have amounted to about 7 per cent if all the potatoes were stored.

Petrol fumigation

The limiting factor in the successful storage of potatoes in Poona district is the tuber moth, *Phthorimoea operculella*, and provision has been made in the Scheme for fumigation of affected potatoes with petrol. For this purpose four concrete chambers have been constructed at the Poona Agricultural College, and arrangements are now complete for fumigation of 1000 bags of potatoes a day. The cost of fumigating a ton of potatoes in bags comes to 4 as. at the current rate of Rs. 2-1 per gallon of petrol.

The Potato Storage and Supply (Military) Scheme has now been reorganized and enlarged so as to provide for a supply of 30,000 bags of potatoes per month to the Defence Department for about 9½ months in the year. Under the extension scheme 1,50,000 bags of potatoes will require to be stored from February to June 1944, and the results of storage during this period will be watched with great interest.



A typical thatched shed for storage of potatoes in Poona

PLATE 10

ESTABLISHMENT OF SHEEP-BREEDING UNITS IN ORISSA

By U. Patnaik, B.Sc. (Ag.)
Livestock Officer, Orissa

According to the Season and Crop Report of Orissa for 1939-40 the population of sheep in Orissa is 2,69,927. Sheep are reared by the poorest classes and are kept purely for mutton and manure in flocks of 10 to 100. There is indiscriminate breeding and rams are allowed to run with the ewes all the year round with the result that ewes lamb at odd times when unfavourable climatic conditions and poor grazing cause unthriftiness and high mortality among lambs. They are of nondescript type and are speckled with coarse, short, hairy, inferior and weak fibres seriously lacking in crimp and density and commercially unsuitable. There is also shedding of wool. Flocks are not uniform and various types are seen in one flock. The average body-weight of sheep is about 35 lb. and the annual yield of this inferior type of wool from a local sheep is only a few ounces. Very few sheep are shorn in Orissa as shearing is uncommon and the quantity of wool obtained is so small that the owner does not consider it worth the trouble and labour. But the ideal conditions prevailing in this province afford tremendous scope for the improvement of wool by adopting proper management, systematic breeding, feeding, control of diseases, etc. of sheep.

Bikaneri breed

It has been determined that Bikaneri rams imported into Orissa for grading up the indigenous sheep are suitable and that even the first generation of the graded progeny show marked improvement in quality and quantity of wool and size for mutton. The average body-weight of the adult graded progeny was 55 lb. and the average annual wool yield from each was 2·5 lb. as against 35 lb. and 0·25 lb. respectively of the indigenous stock. The experience obtained is now being utilized for extensive improvement of the indigenous sheep and their wool in the villages so that sheep-owners may get a better return from their sheep, as sheep respond well when looked after and form a profitable adjunct to agriculture.

In the mass improvement of livestock the major part has to be played by the livestock-owners themselves. Government farms under controlled conditions and expert supervision may best coordinate the efforts of the livestock-owners by producing and supplying the required number of pedigreed sires, trying out the efficiency and economy of improved methods under local conditions before they are introduced into the villages, and giving training to departmental staff as well as interested members of the public in sheep husbandry. Such of the results as may be deemed to be of practical utility under village conditions should be extended to the village flocks on as wide a scale as possible, as work on Government farms alone is not going to solve the problem of mass improvement. Great success has been achieved in South Africa in the improvement of village flocks through the efforts of the Government extension officers, and it is the desire of this Department to do work on similar lines in this province so as to obatin quicker results.

Breeding units

Under local conditions, with nondescript sheep, the best and the easiest way of effecting their mass improvement is to create and establish in every village economic sheep breeding units, each with a minimum of 50 selected young (two teeth) healthy ewes, preferably of white colour and as uniform a type as possible. This should be followed by a system of grading continuously till the sixth generation with pure-bred Bikaneri rams capable of transmitting their characters to the progeny, and culling the male as well as the undesirable female progeny on the basis of actual records of production and disposing of them as fat stock. At the sixth generation, Orissa will have a breed of sheep of her own with 98·5 per cent of Bikaneri blood, and for all practical purposes, they can be considered as a pure breed which will breed true to type.

A modest beginning has been made by the Government of Orissa, with 24 young pure-bred pedigreed Bikaneri rams which have been supplied free to the owners of the sheep-breeding units established in the province, for grading up the local stock. Orissa as yet has no livestock breeding farm to breed any pure-bred

livestock and to meet the needs of the province for the supply of the required number of pedigree sires. Some of the interested zemindars have been induced by the Orissa Civil Veterinary Department to purchase Bikaneri ewes and establish pure-bred Bikaneri flocks. They have purchased pure-bred Bikaneri ewes from the home of the breed and have imported and established pure-bred Bikaneri rams to breed pure stock so as to supply to a certain extent the requirements of the province for stud animals.

Free services

The sheep-breeding units established are being supervized and guided by the staff of this Department. These units are receiving the following free services from the Department :

(1) Free supply of pure-bred Bikaneri rams for breeding purposes.

(2) Regular drenching of sheep with parasiticides. This is to be carried out once a month during the rainy season and once in two months thereafter.

(3) Dipping of sheep in a parasiticide solution twice a year, i.e. after each shearing.

(4) Washing of sheep before shearing, shearing with improved shears under expert supervision and classification of wool.

(5) Proper marketing facilities for the disposal of improved wool at suitable rates through the help of the Provincial Marketing Department.

(6) Free veterinary service for the control of contagious and other diseases, docking of lambs, castration, etc.

(7) Marking of sheep by means of tattooing forceps, and

(8) Free advice on matters pertaining to economical methods of feeding, housing, management of sheep, etc.

Each veterinary assistant surgeon and stockman is being provided with drenching equipment, the necessary drugs, etc. and in each district there will be a portable sheep dipping vat and a pair of tattooing forceps to be used in turn by the various sheep-breeding units. In each district trained shearers with improved shears will be appointed to train local men in shearing. The wool produced in these units will be supplied to the Textile Expert, Orissa, at a reasonable rate for producing blankets for the Army, Police and Jail Departments.

Quality important

Improvement in the quantity of wool can be made by proper feeding and systematic breeding, and coloured wool can be eliminated by careful selective breeding. But the quality of wool is a complex problem. This can be tackled by carrying out detailed laboratory analyses of samples of wool not only from different individuals, particularly breeding rams and ewes, but also from different parts of the body, viz. neck, withers, shoulders, sides, back, britch and belly of the same animal. Detailed analysis of this type is essential to improve the quality of wool. But under village conditions such analysis may not always be possible or convenient. Some of the common defects in our wool, besides colour, are complete or partial hairiness, irregularity of fibres, lack of crimp and harsh handling. Except partial hairiness all these defects can be noticed with a little experience by the naked eye. Complete hairy fibres appear milky white when placed on a black background. So they can be easily detected. This simple test and naked-eye examination can help one to a large extent to select suitable stock for breeding and improvement. It is only when wool analysis is made use of in the selection of stock for breeding that better type of wool required by the trade and at present imported from abroad can be produced in this country. Each sheep-breeding tract, therefore, requires a laboratory to carry out wool analysis. The question of establishing a wool analysis section at the Provincial Veterinary Laboratory, Cuttack, is under the consideration of the Government.

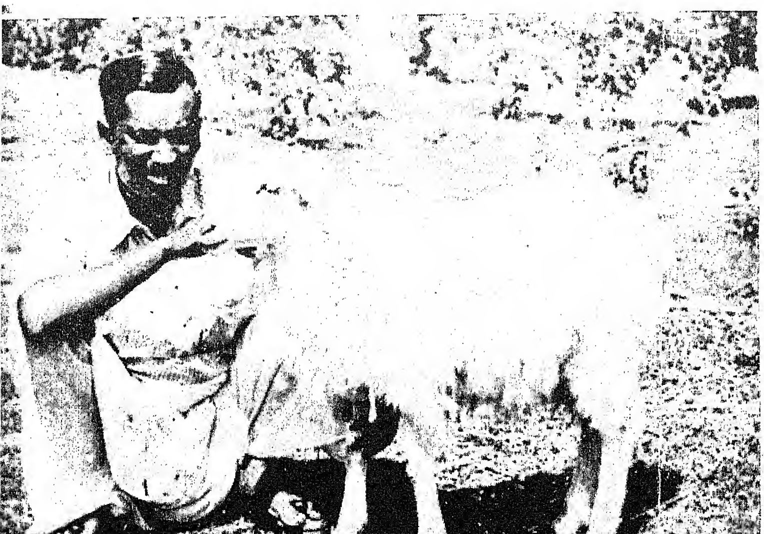
For a progressive improvement of this industry the maintenance of progeny and production records of breeding rams and ewes and also of lambs is of great importance to weed out the undesirable ones. So it is proposed to maintain such records at the different sheep-breeding units in accordance with the recommendations of the Imperial Council of Agricultural Research.

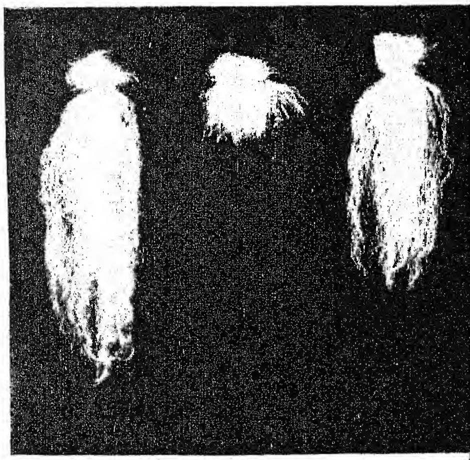
Bikaneri ram

Local ewe

PLATE 11

F$_1$ Generation lamb (6 months old) showing improvement of wool and size





Wool obtained from Bikaneri, indigenous and F$_1$ generation (left to right) showing improvement in quality and the quantity of wool

NUT GRASS AND ITS ERADICATION

By R. A. Pillay, B.Sc. (Ag.)
Farm Manager, Livestock Research Station, Hosur

FARMERS know only too well that Nut grass (*Cyperus rotundus* Linn.) is one of the worst weeds which if once allowed to take root in fields establish themselves well and they defy all ordinary methods of eradication. Yet they are unable to prevent this weed from getting into their fields either through manure, tank silt and irrigation water or through natural methods of dispersal of seed; nor are they able to control it when once it infests their lands. They are helpless as no effective remedy has so far been found out for their benefit.

Nature and growth

Nut grass is an erect, dark-green glabrous herb growing to a height of about 9 in. The vegetative portion seen above the surface is only the aerial shoot whereas the real stem is hidden under ground. This underground stem is scientifically known as stolon. From the base of this aerial shoot the first stolon gets into the soil to a depth of about 9 in. and forms a tuber commonly referred to as nut. This tuber in turn gives rise to several branches radiating on all sides forming tubers at intervals of about 9 in. These tubers contain a considerable amount of stored food and are themselves capable of producing new plants. Thus a single plant spreads and covers a big patch of ground. That is why we see Nut grass in patches. Sometimes these patches become so numerous that the entire field look as green as if a crop is growing.

Nut grass is further capable of propagating by seed and it is by this method that it spreads quickly. Being a perennial, it stands in the field for a number of years, every year multiplying and spreading, making the land unfit for cultivation. The class of soil is no barrier to its spread as it is found to thrive in all kinds of soils under different conditions of temperature and moisture. On the other hand it grows with greater vigour in rich loamy and garden soils.

Extent of damage

The trouble this weed gives the ryot is enormous. Its patches do not admit of easy ploughing and thereby raise the cost of cultivation. It delays sowing by not allowing the field to come into condition in time. When crops are sown in an infested field, it comes up quicker under favourable conditions and smothers the former. The crop thus becomes patchy and thin with the result that the yield is reduced by as much as 50 per cent. In vegetable gardens and valuable nurseries where frequent manuring, irrigation and deep tillage are done, the damage done is considerable. In wet lands so long as the water is available in plenty, it does not do much harm. But in times of scarcity of water puddling is made difficult. In years of drought when the wet fields dry up, it grows more luxuriantly and chokes up paddy crop, especially where paddy is raised under semi-dry conditions. Sometimes the infestation of the weed happens to be so extensive and eradication becomes so difficult that the ryots are forced to abandon the cultivation of the fields altogether. In the intensive drive at the present moment to grow more food all these fields have to be brought under cultivation and the eradication of the weed is a pre-requisite for successful cropping.

Methods for eradication

Several methods have been suggested and adopted for its control. One of the methods is to plough the land immediately after the harvest and keep the land clean of weeds by passing a blade harrow frequently till the sowing of the next crop after the break of the monsoon, so that Nut grass shoots may be destroyed as and when they appear above ground. It is presumed that by the destruction of the shoots, the underground stems or stolons can be starved out to death. A trial of this method in several fields of varying intensity of infestation over a period of six months from December to June has undoubtedly helped to keep down the Nut grass and enabled the crop sown in the next monsoon to have a good start before the weed could do any appreciable damage. But generally weeds continue to persist, grow with the crop and set seed, especially when the nature of the crop put in is such that no intercultivation or hand weeding is possible beyond a certain stage of the growth of the crop. This

method is therefore sometimes found unsuitable.

The other method recommended is to dig the land deep with a hand hoe specially designed for the purpose known as *kuddali*, trace the tubers, collect and burn them. By adopting this method it is found that it requires at least 200 to 400 coolies to dig out the tubers from an acre of land according to the degree of infestation. In spite of putting such a large number of coolies on this work and close supervision a large number of tubers are carelessly left out. Sometimes the colour of the soil is as dark as the tubers so that the latter escape notice. Moreover the stolons are found to go as deep as 2 ft. or more beyond the reach of the implements so that they are left out. After sometime these tubers come up, grow afresh and have to be carefully watched and dug up again. This method is therefore very expensive and uneconomical for adoption in all fields excepting perhaps very valuable nurseries and vegetable gardens, at a very early stage of infestation.

Growing of a dense smothering crop like sweet potato in an infested field where irrigation facilities exist, was tried as a third and cheaper method of exterminating the pest. The trial has shown that in the early stages, the crop has to be hand weeded and kept clean lest the Nut grass gains an upper hand and smothers the sweet potato crop instead of itself being smothered. If the crop comes up well and covers the ground completely and remains so for over five months in the field it certainly smothers the Nut grass to a great extent although after harvest some of the tubers have been found to survive and spread. This method has its own limitations and has not been found to be efficacious in rooting out the weed completely although it has gone a long way to put it down. As irony would have it the sweet potato crop while putting down Nut grass establishes itself so well that it becomes a pest to the subsequent crops.

Guinea grass

Guinea grass (*Panicum maximum* Jacq.) which remains in the field for several years and which smothers the weeds like sweet potato without the disadvantages of the latter has been tried as a substitute for sweet potato in very badly infested fields and found to completely eradicate Nut grass in a most effective and cheapest possible manner[1].

It may be planted in lines 3 ft. apart each way with facilities for interculturing with a junior hoe and blade harrow. Nut grass has to be kept under control in the beginning by the interculture of the crop with the above mentioned implements and by one or two hand weedings round the planted slips till the latter are well established. With the establishment and growth of Guinea grass the Nut grass begins to lose its ground gradually. It takes three to four months to start the damage when the Nut grass shoots get thin and stunted, the leaves becoming narrow and pale. In about six months the aerial shoots die out, in most cases setting the rot of the underground stem. It is found to persist only in places where the Guinea grass slips fail to establish or in gaps along the *bunds* and corners. When such gaps are carefully noticed and planted, the weeds perish there also, with the growth of the crop. In about a year not only the shoots but the underground stems also die.

If Guinea grass is left for more than a year the destruction of the pest becomes complete. The longer the Guinea grass is kept in the field the more assured is the destruction. The writer has seen that sometimes other annual weeds grow in between Guinea grass but never Nut grass. It may be that Guinea grass may secrete a toxin which destroys the Nut grass, but this aspect of the problem has not been investigated.

Guinea grass as fodder

Guinea grass is a crop which is easy to grow and which thrives in all kinds of soils. It can be raised both under dry and irrigated conditions. It tolerates heavy watering though not water logging and stands the most serious drought for months. Hence there would be no difficulty in growing the crop. If irrigation facilities exist a very good and nutritious fodder can be obtained continuously for the farm stock. The ryots will therefore do well to include Guinea grass in their cropping scheme in rotation with grain or root crops in badly infested fields so that not only the Nut grass can be exterminated but also a continuous supply of green succulent fodder can be obtained for their cattle.

[1] The remedy suggested of growing Guinea grass to kill Nut grass is no doubt a useful one but it is not suitable for general adoption. It is a crop worth growing for fodder purposes and thrives well under irrigation and due to its expanding growth it has an effect on killing Nut grass to a certain extent. The experience has been that for general adoption in reducing Nut grass, good ploughing, removal of nuts, broader spacing between lines and frequent interculture to kill the sprouted green parts, green manuring with good cover crops are suitable remedies.—Ed.

CATTLE TUBERCULOSIS AND ITS CONTROL

By L. Sahai, M.Sc., M.R.C.V.S.
Research Officer, Imperial Veterinary Research Institute, Mukteswar

THERE are three different types of tuberculosis, i.e. tuberculosis as it occurs in human beings, in cattle, and in fowls respectively. In this article cattle tuberculosis alone will be dealt with.

Until some three decades ago, there used to be a common belief in this country that cattle tuberculosis was a very rare condition meriting little attention from stockmen or animal husbandry workers, but investigations carried out during the last 25 years have shown that the disease is fairly widespread throughout the country, though its incidence varies from place to place and even from herd to herd. Generally speaking, the disease appears to be more common in the Punjab, Bombay, and one or two other provinces than in the rest of the country.

Disease of domestication

Tuberculosis is a disease of domestication and the more intensive the conditions of domestication under which the animals are kept, the greater is likely to be the incidence. The disease is, therefore, more commonly met with in animals kept under herd conditions, and large herds are more commonly infected than small ones. But this is by no means always so, for the incidence of the disease is determined more by the degree of overcrowding, general standard of cleanliness, etc. observed in a herd than by mere numbers. Contrary to the old belief that tuberculosis was a constitutional or hereditary disease, one now knows that it is a purely infectious disease, and its presence or otherwise in a herd depends solely upon whether infection has or has not been allowed to get among the animals. It is not uncommon to find large herds which are free or almost free from the disease and small ones which are badly infected.

Indian cattle are generally supposed to be more resistant to tuberculosis than the highly-bred foreign cattle, but evidence on this point is still rather inconclusive, and it is not unlikely that the relative freedom of our cattle from tuberculosis is simply due to their being kept in smaller groups and under more open-air conditions than is the case in the highly-developed countries of the west, where the demands of the dairy industry and climatic conditions require the animals to be kept closely associated together in large buildings or byres. However, even if the greater resistance of our cattle is conceded, it is not of a degree that will prevent the animals from getting infected, once opportunities for such infection are allowed. There exist in this country herds in which the infection is as high as 20 per cent, and in a certain small herd it is 85 per cent.

Nature and causes

Tuberculosis is caused by a small organism, commonly referred to as the tubercle bacillus, which cannot be seen with the naked eye. Animals in an advanced stage of the disease expel large numbers of these organisms in their natural secretions and excretions, such as the sputum and faeces, sometimes also in the urine, milk and uterine discharge. The organism possesses a marked resistance to the action of chemicals and disinfectants and is capable of surviving under dark, humid and dirty conditions, such as sometimes obtain inside byres, for prolonged periods, though it is relatively easily killed under warm and dry conditions, and especially in the presence of sunlight. Animals get infected from organisms which have been voided by some other animal, and infection takes place either from the ingestion of food contaminated with the infective discharges or through the inhalation of bacilli contained in particles of dust or in the breath of an animal affected with tuberculosis of the lungs. The former mode of infection is common in calves, which contract the disease through milk contaminated with tubercle bacilli, but in adult cattle infection usually takes place by way of the lungs.

In the beginning, the disease remains localized, and in some animals due to their natural resistance it may remain in this condition throughout life; while in others it makes a slow but steady progress affecting a number of internal organs and sometimes even the uterus and the udder.

Udder tuberculosis is a very dangerous form of the disease, since the milk secreted by a tuberculosis udder always contains enormous

numbers of bacilli and is thus highly infective. Tuberculosis is sometimes classed as either 'closed' or 'open'. When all the tuberculous areas in the body are so situated that no organisms are being given off or discharged in the secretions, the condition is known as 'closed tuberculosis'. Animals so affected do not transmit the infection until they become so diseased that the tuberculous areas open into a passage leading to the exterior of the body. The animals are then said to be affected with 'open tuberculosis'. But at times it is very difficult to say, despite the most careful clinical examination, whether a case is an 'open' or a 'closed' one, and therefore it is always wise in practice to regard any animal confirmed as a case of tuberculosis to be a potential source of infection to other animals. It has to be borne in mind also that an animal affected with closed tuberculosis may in due course and under conditions of stress, such as over-work, under-feeding, effect of debilitating diseases, repeated pregnancy, etc. become an open one.

Symptoms

In the early stages, while the disease is still localized, there are usually no symptoms at all, but once the disease has become generalized certain characteristic symptoms appear. These usually take the form of chronic emaciation and a short, dry, husky cough, since it is the lungs which are most commonly affected. Sometimes in advanced cases the intestines get infected from the swallowed sputum, and the animal then suffers from a persistent diarrhoea which does not yield to treatment. In most cattle these are the only symptoms seen. The disease runs a slow chronic course, extending from some months to years, but once it has become generalized it almost always ends fatally.

In a certain proportion of cases the udder becomes infected but, generally speaking, this does not take place until the disease has reached an advanced stage. Tuberculosis of the udder is characterized by a hard, painless enlargement of the gland, usually of one of the hind quarters. The milk is not altered in appearance at first but later becomes flaky and considerably reduced in quantity.

Tuberculosis of the uterus usually results in the birth of a tuberculous calf and, if severe, in abortion and sterility; but this, like tuberculosis of the udder, is a rare occurrence.

It may be mentioned that symptoms similar to those above described may be caused by a variety of other conditions, and a diagnosis of tuberculosis should not be given without a very careful examination. In fact, one of the most common causes of emaciation in this country is chronic starvation and malnutrition.

In all suspected cases, skilled assistance in diagnosis must always be sought. Delay in the diagnosis of a case may lead to dangerous spread of the infection to other animals.

Tuberculin test

A very reliable method for the diagnosis of tuberculosis is the tuberculin test. Tuberculin is a thick, viscid liquid, prepared from the tubercle bacillus, and it has the property of evoking, when injected into the body of an animal, a certain type of reaction which enables one to say whether the animal is tuberculous or not. The method of testing that is commonly employed is the double intradermal one and consists in the injection of a drop of tuberculin into the centre of a shaved area of skin in the middle of the neck, followed by an injection 48 hours later of a similar quantity in the centre of the swelling resulting from the first injection. The injection site is examined 24 hours after the second injection, and if there is present a large soft swelling with or without heat and pain, the animal is considered as positive, while if there is only a small hard pea-like swelling, the animal is declared as negative.

The tuberculin test only tells us that an animal is infected; it gives no indication as to the location of the disease or its extent. It has the advantage that it detects even those cases which are affected with a very mild form of the disease and are not showing any symptoms, but it sometimes fails in the case of animals affected with very advanced tuberculosis. These cases, however, can, as a rule, be detected clinically. Animals very recently infected, but which have not developed definite disease, may also fail to react (incubation stage).

Importance of cattle tuberculosis

This leads one to a consideration of the control measures. The disease having been diagnosed in a herd, the question arises: what should be done to get rid of it and why should the attempt be made? It would be logical to consider the second part of this question first. It is necessary to eradicate tuberculosis, firstly, because it reduces the productivity and the productive life of an animal, and, secondly, because it is transmissible to

other domesticated animals, such as goats, sheep, pigs, horses, camels, elephants and dogs (it is not transmissible to poultry), and to man.

The bovine type of disease in man is clinically and in other respects indistinguishable from the true human disease. Infection usually results from the ingestion of milk containing tubercle bacilli, and in countries where tuberculosis is more rife and raw milk is consumed, bovine infections are responsible for a good deal of mortality and suffering, especially in children. But the adult type of disease called chronic pulmonary tuberculosis or phthisis can also be caused by tubercle bacilli from cattle, and it seems possible that infection may at time be acquired directly from infected cattle by inhalation. Fortunately, due largely to the practice of boiling milk which appears to be common throughout this country, bovine infections appear to be very rare in India. However, in view of the potentially dangerous nature of bovine tuberculosis, care should be exercised in dealing with diseased animals and in handling and consuming the milk and other products derived from such animals. It is also necessary to bear in mind that it is not only the tuberculous udder that secretes infected milk, but perfectly healthy milk may also at times get infected and be rendered dangerous through its getting mixed with the faeces, etc. of a tuberculous animal. Milk, however, is rendered safe for human consumption if it is boiled or heated at 145°F or 62·8°C for half an hour (pasteurization).

It may be stated here in parenthesis that human and avian types of tuberculosis are practically never transmitted to cattle, and, if transmitted at all, the resulting disease is insignificant and causes no symptoms.

One may now revert to the main question : How to control the disease ?

Control and remedy

It may be stated at once that there is no useful medicinal treatment for tuberculosis, nor is there any method of serum inoculation or vaccination, such as one has against rinderpest, which is of much practical value. In planning an attack on the disease, one employs a knowledge of its infectious nature and of the fact that the great majority of calves in tuberculous herds are born healthy and become infected only after birth. The method that is commonly employed for the control of tuberculosis is the 'Bang method', named after the Danish veterinarian, Bernhard Bang, who first tried it in Denmark. The method consists in the elimination of all animals affected with open tuberculosis by clinical examination, in tuberculin-testing of the rest and segregation of these into an infected group and a non-infected group which are kept rigidly isolated from one another in separate buildings with separate attendants and separate grazing grounds, and in rearing the calves born of infected mothers on milk known to be free from tubercle bacilli. If separate buildings are not available, a wooden or brick partition is constructed between the two groups and each is provided with a separate exit.

The healthy group of animals is tested once every year or once every six months to detect animals that may have been missed at the previous test or got infected in the meantime. Reactors are transferred to the infected group. The calves born in this group are allowed to remain with their mothers. New additions from outside are not made, unless they have passed the tuberculin test.

The animals in the infected group are not tested again, but a close watch is kept on them and animals showing signs of open tuberculosis are at once removed from the herd and slaughtered. The calves are allowed to suck their mothers for a day and then immediately weaned and removed to the healthy section of the herd where they are kept on milk from healthy cows or milk that has been heated or boiled. In this way the group of healthy animals is gradually increased, while the infected group goes on decreasing until eventually after the removal of all the affected animals the herd consists only of healthy animals.

The two essential features of this method of control are, first, the immediate weaning of newly-born calves and, second, the elimination of open cases of tuberculosis by slaughter. As regards the first, if it is not found practicable to carry out immediate weaning,—and this is likely to be the case in many herds in this country,—the calves may be allowed to suck their mothers but they should be kept in a separate building away from the infected animals and allowed access to their mothers only at the time of milking, and before being added to the healthy herd they should be tested with tuberculin, preferably twice with an interval of a month between the two tests, to make sure that no tuberculous animals go over and spread infection among the healthy animals.

As regards elimination of infected animals by slaughter, this is not likely to meet with the

approval of a good many owners in this country on religious grounds, but it is well to realize that animals affected with open tuberculosis are a dangerous source of infection to other animals and their elimination from the herd at the earliest possible moment is in the best interest of the herd, and, therefore, in that of the owner himself. If the objections to destruction prove absolutely insuperable, then such animals should be kept rigidly isolated as far away from other animals as possible until they die naturally.

Side by side with these measures, the usual principles of hygiene should also be observed such as the provision of proper ventilation in buildings and impervious floors to stables, careful removal of dung, litter, etc., and above all the avoidance of overcrowding.

Here a word might be said about the status of a valuable bull which has reacted to tuberculin, but is otherwise not showing any signs of the disease. The likelihood is that such an animal is not a source of danger to other animals and there is no harm in using it for breeding purposes, provided it is allowed contact with the cows only during the actual period of service. However, as soon as symptoms of the disease appear, it should be eliminated.

The Bang method of control has been used with great success in certain countries in ridding herds of tuberculosis, but its application requires patience, perseverance, and attention to detail. Carelessness and half-heartedness will only delay the eradication of the disease and result in disappointment.

Position abroad

In conclusion, it may be pointed out that in some of the European and American countries, where tuberculosis is extensively prevalent, legislation exists for the compulsory reporting of all open cases of tuberculosis and enormous sums are being expended on schemes aimed at the eradication of the disease. In this country the law does not require the compulsory notification of any type of tuberculosis, nor are any restrictions placed on the sale of even highly dangerous animals, but if stock-owners will realize the dangerous nature of the disease and act accordingly, they will have done much to eradicate the disease, or, at any rate, to prevent its further spread.

FATS FROM GRASS

CANADA'S butter and cheese are made chiefly from milk produced by cows on pasture. Sixty-three per cent of the 1942 creamery butter was produced during the period from May 1st to the end of September, full pasture months. Another 14 per cent was made during April and October, partial pasture months. Eighty-six per cent of the cheddar cheese was produced in the same seven months. The major portion of the milk produced during the winter months is consumed as fluid milk. These facts indicate clearly that Canada's pastures determine the ability to supply butter and cheese to Britain, says W. M. Fleming, Dominion Experimental Station, Summerland, B.C.

A cow producing one pound of butterfat per day requires approximately 100 pounds of grass. She requires at least 7 or 8 hours to remasticate this quantity as she cannot graze and chew her cud at the same time. If the time out of the pasture for milking is added, it is evident that grass must be luxuriant or it becomes a physical impossibility for the cow to gather that quantity of grass in the remaining hours of the day. Milk sheets should be scanned regularly. If a decline is noted it indicates a change of pasture is advisable. At least three pasture fields should be maintained. If they are planted with different grasses so much the better. The cow likes variety in her diet. Pastures should be grazed in rotation.

Fertilizers used judiciously on pastures pay handsome dividends. Modern methods of cultural management such as clipping to prevent seeding, harrowing to break up manure heaps, weeding, irrigating or draining applied at the proper time, all contribute towards economical production of fats from grass. Pastures merit care and attention.—*Department of Agriculture, Canada.*

CONTROL OF SUN-SCALD OF PEACH TREES IN KUMAUN

By U. B. Singh, M.Sc., Assoc. I.A.R.I.

Government Fruit Research Station, Chaubattia, United Provinces

STONE-FRUIT trees such as peach, apricot, plum, cherry and chestnut in Kumaun are badly affected by sun-scald. It causes injury to the bark and with the cracking and peeling of dead bark open wounds or cankers are formed. These cankers are always formed on the south-west face of the tree trunk from the ground upward, on the sun-exposed surface of large branches or at the junction of scaffold branches with the main trunk. All attempts to isolate a parasitic pathogen from diseased tissues failed and hence it was concluded that no fungi or bacteria are responsible for this canker and the trouble is physiological.

Causes of infection

Sun-scald is known in all the fruit growing countries in the world. According to Mix and others the sun-scald of fruit trees is a type of winter injury and believed to be brought about by some interaction of sun and cold on the sunny side of the trunk in late winter. Mix found the injury most in trees leaning to the north-east. The part of the trunk midway between the crown and the head was injured most often. He recommended spraying of trunks with whitewash in early winter. Stone and Harvey recommended shading of trunk with board or lath screens. Khan and Khan in North-West Frontier Province and Lal Singh in the Punjab have recommended whitewashing of tree trunk for protection against sun-burn.

The disease was recorded for the first time in Chaubattia, United Provinces by the author in 1934 and was subsequently recorded in all other orchards in Kumaun. In some parts of Kumaun this disease has done considerable damage to stone-fruit trees. The affected trees become weak, bear less and in very advanced cases the trees die. The desirability of an effective and cheap control was keenly felt and with this point in view a replicated control experiment was laid out at the Government Orchard, Chaubattia in 1935.

Control

The following treatments were carried out:

(1) Untreated control (branch exposed to the sun).

(2) Bordeaux paste alone (branch exposed to the sun).

(3) Bordeaux paste with shade (branch in shade).

(4) Self-boiled lime-sulphur paste (branch exposed to the sun).

(5) Self-boiled lime-sulphur paste with shade (branch in shade).

(6) Shade alone (branch in shade).

Preparation of pastes

Bordeaux paste was prepared in the following method :

First a solution of 4:4:50 Bordeaux mixture was made. It was dried to a powdered state and then 4 oz. of this powder was added to 100 c.c. of raw linseed oil to make Bordeaux paste. Self-boiled lime-sulphur paste was prepared with 4 oz. of self-boiled lime-sulphur, the proportion of quicklime and sulphur being 2 : 2 mixed in 100 c.c. of raw linseed oil. The shade was made by tying straw all round the treated and untreated trunks. Both the pastes were applied with paint brushes on all sides of the main trunk of the trees.

Observations taken from 1940 to 1942 have shown that the disease can be very successfully controlled by tying straw all round the main trunk. This treatment will also hold good for other stone-fruit trees. Cultural practices such as pruning so as to induce low heading also reduce sun-scald.

MARVELS OF RUMINANT METABOLISM

By R. Mukherjee

Animal Nutrition Section, Imperial Veterinary Research Institute, Izatnagar

IN his practice of agriculture, the farmer deals with two classes of living things, plants and animals. The plants manufacture their food with the help of sunlight from the matter they absorb from the soil and carbon dioxide from the air. The animals depend on plants for their food. Of the important farm animals, the horse, ox, buffalo sheep and goat habitually eat plant materials alone ; hence they are called herbivorous animals ; the pig and the barnyard fowl eat both animal and plant substances. Of herbivorous animals, those that chew the cud or ruminate are called ruminants. With the exception of the horse, pig and fowl all the animals mentioned above are ruminants.

How food is digested

The food of animals consists of a mixture of ingredients, such as proteins (meat-like substances), fats (fatty and oily substances), carbohydrates (starchy and sugary substances), minerals, vitamins and water. Proteins, fats and carbohydrates are each composed of simpler constituents bound together. The purpose of digestion is to convert complex and insoluble food substances into their simple and soluble constituents which are readily absorbed into the body and utilized there. All animals, except the most primitive ones, are provided with highly developed digestive systems.

The digestive tract of a typical mammal (mammals are animals which suckle their young) may be described as a tube extending from the lips to the anus. Throughout its length the tube contains some dilatations and constrictions which form a number of compartments, namely oesophagus, stomach, small intestine and large intestine ; each of these has a specific function in the digestive process. The oesophagus passes the food from the mouth to the stomach and from stomach to the intestines, the undigested residue being passed out through the anus as faeces. The conversion of food constituents into soluble form is effected by various digestive juices with which it comes into contact while passing through the stomach and the intestines, but their action is facilitated by the preliminary grinding of the food by the mouth and jaws and the constant kneading by the muscular stomach and intestines. After food is digested, the products of digestion are absorbed into the system where they may either unite with oxygen, with the production of energy or be stored as body substance. Metabolism includes all the processes (mentioned above) undergone by food constituents in the body from the moment food is taken until they are finally disposed of.

The above description gives an idea of the working of a typical digestive system. The digestive process of different animals varies a great deal, depending on the type of diet they habitually eat. Hence, differences exist in certain portions of the digestive tract to accommodate the special requirements of the species. For example, in the domestic ruminants, in addition to the true stomach, there are three additional compartments called forestomachs.

Peculiarities of ruminant digestion

The story of the evolution of the ruminant stomach is interesting. It is believed that millions of years ago the land surface of the earth was covered with forests. At a later period the shrinking of the forests and the extension of grassy plains took place. This encouraged the evolution of ruminants which are grazing animals. The wild environment required them to bolt their food hastily on reaching a suitable grassy spot and grind it later when they had retreated to a safer place ; probably in order to meet this necessity, the swelling of the oesophagus with the formation of forestomachs occurred. Man's ingenuity has gradually brought many of these animals (oxen, buffaloes, sheep and goats) under domestic use while many (antelopes, deer, bison, giraffes, etc.) still exist in the wild state. Since the dawn of civilization, the ruminant has occupied a special place in agriculture, as it can utilize the bulky and coarse products of the farm for which little other use can be found.

Ruminants are particularly suited for dealing with coarse fodders due to the capacious forestomachs they possess. To what extent the structure of the ruminant stomach is adapted

for this purpose will be evident from the following figures. The capacity of the stomach of the pig is 2 gallons, the sheep 5 gallons, the horse 4 gallons and the cow 43 gallons. Its functional adaptation is similarly striking. The peculiarities of ruminant metabolism originate from the complexity of their stomach. The first of the forestomachs (the rumen) is very large and acts as a temporary store house for the food which they hastily swallow; the second one (the reticulum) which is very much smaller acts as a store for water, and the third (the omasum) which is rather larger than the second gives a thorough pounding to the food before it enters the abomasum. The abomasum secretes digestive juices and is comparable with the stomach of other types of animals. The small and large intestines of non-ruminant herbivores are rather more complex than those in the ruminants, particularly so in the horse. The horse, although simple stomached, has a large and more complicated intestine (capacity of the large intestine of the horse is 30 gallons compared to 8 gallons of the cow) which enables it to deal with coarse fibrous foods—although to a lesser extent than ruminants. The functions of the large intestine of the horse are, in many respects, similar to those of the rumen of the cow.

In non-ruminants, the food material passes into the stomach as soon as it is swallowed and is there brought into immediate contact with the digestive fluids of the stomatch. The action of bacteria upon food taken into their stomach is short-lived owing to the presence of acid in the digestive secretion of the stomach. In the ox and other ruminants the food material after being partly chewed enters the rumen, from which it is later returned to the mouth and rechewed during repose. In the rumen considerable bacterial action is exerted upon the food, this action being favoured by the slightly alkaline reaction prevailing there, its freedom from digestive secretions, as well as by the prolonged sojourn of food matter therein. The rumen also harbours numerous tiny creatures (protozoa) besides bacteria. These minute organisms inhabiting the rumen are not parasitic upon the host ruminant, but, on the contrary, the host and the little 'guests' are of mutual benefit to each other.

The part played by the different types of micro-organisms harboured in the rumen is largely unknown, although more is understood regarding the net result of their action. Their most important function is the breakdown of cellulose (which forms a wall enclosing the bulk of nutrients in coarse fodders) into simpler products. It should be mentioned here that cellulose is not acted upon by the digestive secretions of higher animals. As the cellulose wall is broken down, the nutrients contained in (the cells of) the feed are liberated and thus easily digested. The ability to digest cellulose in the stomach (rumen) and so to liberate the nutrients is an advantage ruminants have over other herbivorous animals, including the horse, owing to the fact that in the case of the former the digestive agents throughout the digestive tract can act on the nutrients set free at the beginning. Consequently, they can extract much more nutrients from a given coarse fodder than can a non-ruminant.

Privileged position of ruminants

Although the ruminant is a higher type of animal, it shares some of the privileges enjoyed by simplest forms of life such as bacteria. It is believed that rumen bacteria, like most other bacteria, have the ability of converting certain simple nitrogenous materials into their body protein and of manufacturing certain members of the vitamin-B group. These explain two interesting phenomena, namely that ruminants, unlike other higher animals, (1) can utilize simple nitrogenous compound such as amides, urea and ammonium salts in place of a part of the food protein and (2) do not depend on their food for the supply of certain B-vitamins, which are essential for life processes.

According to some investigators, sheep can convert mineral sulphur into sulphur-containing proteins of wool but the proof of this conversion is not completely established. It should be noted here that the present knowledge indicates that other higher animals cannot possibly utilize mineral sulphur for body purposes. The ruminants are also capable of manufacturing vitamin C somewhere in their body, but this characteristic is by no means peculiar to ruminants, as pigs, fowls and rats also have this capacity.

Some observers hold the opinion that many ruminants are immune to certain poisonous feeds; if this can be confirmed by direct experimentation it will be a fact of considerable interest.

Modern feeding practice

Although ruminants are able to dissolve cellulose, they can only digest from 35 to 75 per cent of the crude fibre (comprising of cellulose,

lignin and certain other constituents) of most feeds. The cause of the imperfect digestion of fibre even by ruminants is mainly due to the fact that the micro-organisms that bring about this change in their digestive tract have little or no action on a substance called lignin, with which cellulose may be associated in varying degrees in plant materials. Thus lignin to some extent protects the cellulose and other nutrients in feeds from the action of digestive agents. Further, lignin content increases with the maturity of a plant. This means that in straws and mature hays its interfering action on the digestion of other substances is very pronounced.

During the first world war, some European countries were confronted with the task of devising methods for efficiently utilizing home-grown products for livestock feeding. The possibility of increasing the food value of straws by removing the effect of lignin was therefore examined. Such an examination revealed that the association between lignin and cellulose in plant materials could be broken down by treatment with alkali and the energy value of the materials could thereby be greatly increased. Cereal straws are very poor feeds, but as a result of such treatment they were made almost as valuable a source of energy as high quality hay. Renewed interest is now being taken in regard to this problem due to the exigencies of the present war and scientists, both in Britain and in India, have been developing methods of alkali treatment which can be adopted by the farmer. As cereal straws constitute the staple feed of the undernourished cattle population in India, alkali treatment seems to have great possibilities in this country even during peace time.

It is now possible to produce large quantities of urea at a cheap rate. This may lead to the replacement of a part of the concentrate (grains, cakes, etc.) allowance of farm stock with this protein substitute whenever economic consideration demands it. For instance in the Hawaiian islands carbohydrate-rich feeds, such as molasses and pine-apple pulp, are abundant, while protein-rich concentrates are scarce and have to be imported. The introduction of urea there may result in economy. Moreover, as urea is about three times richer in nitrogen than proteins, it can replace a much larger amount of concentrate and, consequently, result in a great saving in shipping space.

It is expected that further revelation of the details of ruminant metabolism will enable the farmer, both in India and abroad, to obtain a much better return from his livestock than he does at present.

VALUE SANITATION AND DISINFECTION

THE best step to take in preventing parasites is the adoption of a system of strict sanitation and disinfection. The poultry house itself should have floors and foundations that are rat- and vermin-proof, and impervious to moisture. It should admit plenty of sunlight, and an abundance of fresh air in all kinds of weather. Poultry quarters, roosts, nests, feed and water utensils should be cleaned and disinfected regularly. The quality of the disinfectant used should be one recommended by a veterinarian, to make sure it will do the proper job. If, in spite of these precautions the chickens do become infested with some parasite, a veterinarian should be consulted so the proper treatment may be given.

Sanitation must be practised, also, in the poultry yard, otherwise soil contamination will build up and continue the old cycle of diseases and parasites for years. Many poultrymen now raise their chicks without direct contact with the soil, for this reason ; some use sun porches with wire mesh or slat bottoms, or small yards surfaced with concrete or asphalt. Good results, too, have been obtained by rotating the poultry range, so the birds will be on fresh ground each season.—*Department of Agriculture, Canada.*

CATTLE POISONING IN ASSAM

By V. R. Gopalakrishnan
Veterinary Investigation Officer, Assam

THE subject of poisoning of livestock through toxic plants and fodders has not received from workers and owners alike in this country, till recently, the attention that it deserves. It was in November 1940 that the subject of fodder poisoning of stock was discussed at the fourth meeting of the Animal Husbandry Wing of the Board of Agriculture and Husbandry in India when very valuable and interesting information was brought to light. While stressing the importance of fodder poisoning, the question of malicious poisoning through poisonous plants, was also considered. This article mainly deals with malicious poisoning of cattle, recently investigated in Assam. Referring to this subject in the annual report of the Civil Veterinary Department, Assam, for 1940-41, it is observed that: 'While contagious diseases reflect very seriously on any attempt to improve the animal industry in Assam, nefarious activities of cattle poisoning by interested parties for hides and bones under the cover of epidemics and sometimes even in absence of epidemics put the last straw on the camel's back so that ignorant ryots sustain heavy losses year after year, seldom realizing the mischief wrought upon them.'

A criminal practice

This puts in a nutshell the importance of the criminal practice of cattle poisoning in the province and also the urgent necessity of suppressing it. Cattle poisoning appears to be fairly common, although in certain localities more cases are reported at frequent intervals. Poisoning of livestock has been known since a long time. It would appear difficult to obtain reliable figures of livestock losses due to poisoning, as only those cases are reported in which large number of animals are involved. A recent case in point was the cattle poisoning in Sunamganj sub-division (Sylhet district) in 1940-41. About 400 cattle died in eight villages and there was evidence indicating that they died of *sui* poisoning (*Abrus precatorius*) administered by a gang of *chamars* with the object of collecting hides. Similar nefarious activities have been reported from other localities also. An attempt was made to investigate the various methods applied in carrying out the mischief, with a view to check it effectively.

Cattle poisoning may be conveniently dealt with under two subheads, i.e. accidental and intentional or malicious. Accidental poisoning of livestock due to ingestion of toxic or toxogenetic plants is recorded almost all over the world, though some of these plants are protected by various means such as unpleasant odour, acrid or bitter taste or by spines. Many species of the Gramineae, some of which constitute the most valuable fodder for domestic animals develop dangerous amounts of prussic acid under certain climatic and soil conditions, especially in times of drought or when the plants are wilting, stunted or young. During the early stage of growth of *jowar* and maize this poison is found, while the mature plant, as well as the seeds are harmless. Dried *jowar* and *jowar* silage never produce poisoning in cattle.

Intentional poisoning

Intentional poisoning of cattle, through mineral and vegetable poisons, has been reported and has also been definitely ascertained. The interested parties who seem to be responsible for poisoning cattle and sometimes goats, are those who trade in hides, skins and bones. They usually employ agents particularly *chamars*, for this purpose. Dealers in bones and hides, resort to this nefarious practice when there is a tendency for prices of these commodities going high. They also do likewise under cover of natural cattle epidemics such as rinderpest, haemorrhagic septicaemia, anthrax, etc. and sometimes even in the absence of epidemics. The methods adopted for poisoning catte are as follows :

(1) *Arsenic poisoning :* This has been known for some years past. Crude or white arsenic is available in the market ; if not, it is stealthily supplied by the dealers to their paid agents who are generally *chamars.* Arsenic is made into a paste, sometimes with a little salt or molasses for taste, and spread over plantain leaf or other edible leaves and fed to cattle. Another method is to sprinkle sufficient arsenic powder on a bunch of moistened *dhub* grass which is

then given to cattle. Arsenic powder in paste form is also smeared over the grass in the grazing plot where cattle usually graze and get poisoned. A less frequent method is to administer arsenic in the form of a ball by placing it at the root of the tongue and allowing the animal to swallow it.

The practice of arsenic poisoning is usually carried out during the course of a natural outbreak of rinderpest. Some of the symptoms of arsenic poisoning bear a similarity to those of rinderpest so that the unsuspecting cultivator is duped into thinking that his cattle died of the prevalent epidemic. The mischief done under cover of an outbreak has also been detected in Assam. In some cases arsenic poisoning has been confirmed on chemical examination of the viscera by the Chemical Examiner, Calcutta. Arsenic poisoning is also reported though to a less extent, in the absence of outbreaks.

(2) *Sui poisoning : Sui* poisoning appears to be a rather more recent practice in Assam than that of arsenic. This is a vegetable poison contained in the seeds of *Abrus precatorius* popularly known as *gumchi, jequirity, rothi* or *kunch.* It is a wild plant found in forests particularly in semi-arid areas. Its active principle is 'abrin' which resembles snake venom. It acts as blood poison and $1\frac{1}{2}$ to 2 grains are sufficient to kill cattle within 48 hours. The decorticated seeds are used maliciously for poisoning cattle by the interested parties. The method of poisoning is as follows: Seeds are well powdered and mixed with gram flour and water to form a thick paste. It is then shaped into sharp cones or needles. Sometimes the paste is filled in the groove of a sharp grooved-spike or needle and allowed to dry ; or the paste is smeared on the point of a sharp instrument. The instrument is introduced into the skin especially where it is soft and vascular. The common region for inflicting the wound is the neck or throat or the hind limbs. Occasionally they inflict the wound inside the mouth during night time when the animal is tied in the shed. At the seat of insertion of the poison more or less extensive oedema is observed involving the subcutaneous tissues ; this lesion is usually prominent if the animal has lived over 24 hours to 30 hours. Acute cellulitis or inflammation of the throat with haemorrhagic lesions develops. The inflammation starts on one side at the region of the throat where the puncture was made.

This method of poisoning is usually resorted to during the outbreak of haemorrhagic septicaemia or black quarter. Here too, the symptoms of poisoning to a certain degree resemble those of the diseases mentioned above. A careful examination of the site of swelling will reveal the puncture. But the cultivator is not likely to suspect poison or, at any rate, might overlook the cause especially when the poisoning is done just after the occurrence of a natural outbreak of contagious disease. This is exactly what happened in the Sunamganj case referred to earlier. The following extracts from a report on field investigation, will indicate the nature of poisoning and the loss suffered.

'Nine cattle fell ill simultaneously in one night and all died in the course of 3 to 5 days. All had swelling in the throat. There was blood discharge from nostrils and anus in all the cases. All the carcases were thrown in the field and the *chamars* removed the skins.'

'In a village, 60 cattle died of swollen throat. In one night 53 fell ill out of which 52 died. Blood smears proved negative for any specific infection. The animals died in the course of 2 to 3 days. Carcases were thrown away and *chamars* took the hides. Last year also it happened like this.'

'About the middle of December last 70 cattle fell ill simultaneously and out of them only five survived. They had swelling on the throat and frothing from nose. They died in the course of 4 or 5 days. Carcases were thrown away and skins and bones were taken away by the hide and bone collectors. It is said that mortality stopped altogether in certain localities where poisoning of cattle was being carried on after the arrest of some *chamars* and their being put in the lock-up for sometime ; and seizure of raw hides in the godown of a hide dealer by the order of the Sub-divisional Officer.'

There are certain features that distinguish intentional poisoning from a natural outbreak of contagious diseases. Poisoning done by *chamars* is remarkable for the very close resemblance of the lesions in the throat produced by *jequirithy* when introduced subcutaneously to those of anthrax or haemorrhagic septicaemia. But the clinical difference is that in poisoning cases, prominent swelling could be observed on one side of the throat and the temperature of the affected animal is almost normal. If the animal is poisoned by puncturing the hind quarters the swelling appears like that of black quarter but without crepitation.

(3) *Other poisons :* Among other poisons oleander (*karbi*) and wild tobacco are reported. It should, however, be mentioned that they are

of rare occurrence ; the most important being arsenic and *jequirithy*.

Preventive measures

In attempting to control malicious cattle poisoning the first step would be to acquaint the farmers and cattle owners with the existence of the nefarious practice to which their cattle are exposed. Sufficient propaganda by lectures, leaflets, etc. should be done so that the farmers are alive to the danger and may take precautionary measures. The interested parties should not be allowed to skin the carcase. A general rule to be observed in such suspicious circumstances is to bury the carcase, preferably after lashing the skin. The cooperation and the active vigilance of the villagers would materially help to curb the activities of the interested parties. Village officials should be instructed to bring all suspected poisoning cases to the notice of revenue, police or veterinary authorities. They should be on the look-out for persons who may be suspected of cattle poisoning.

It need hardly be stated that the collaboration and active support of the executive and police officers of the district will considerably help to check cattle poisoning. In fact, with the help of these officers the control measures as suggested above were carried out in Sunamganj sub-division with very satisfactory results. The effect was almost immediate and no mortality due to poisoning occurred.

In connection with arsenic poisoning, it may be pointed out that the sale of white arsenic should be controlled instead of its being procurable in the open market. Sale should be through a licence-holder who will maintain a register for noting the name of person and quantity issued. This may appear a little difficult but the very fact that there is some sort of control in the sale of arsenic may have a desirable effect.

But of all the measures of control, the most effective will be to make the cattle owners themselves realize that they may easily happen to be the victims of mischief of some people in or near their village who are interested in the trade of hides, skins and bones.

BETTER CARE FOR DRY COWS

BETTER care for dry cows will mean much better milk production when the cows freshen, according to studies recently conducted by leading research veterinarians. During the dry period, the cow is rebuilding herself and storing up reserves which will make her a better milker when she freshens, these studies show. She should be given good, balanced rations, and the same care and attention as if she were on the milking line. The veterinary authorities who made these studies recommend that the dry period should vary from thirty to sixty days. Less than thirty days does not give the cow opportunity to store up sufficient reserves to develop a vigourous calf, it is said, while a dry period of more than sixty days is uneconomical and does not serve any useful purpose.—*Department of Agriculture, Canada.*

What the Scientists are doing

IMPROVEMENT OF COCANADAS COTTON

COCANADAS is the trade name of the variety of cotton grown over an area of some 108,200 acres in the Madras province in the districts of Vizagapatam, Godavari, Kistna, Guntur and Nellore. It possesses a mean fibre length of $\frac{5}{8}$ in. to $\frac{6}{8}$ in. and a ginning percentage of 25. The lint has a natural tint varying from drab to reddish brown and is largely utilized in the manufacture of dyed yarns. It is preferred to white cottons on account of its capacity to absorb dye readily. In recent times, however, there have been some complaints about a general deterioration in its quality due to the admixture of inferior white cotton grown in parts of the districts of Guntur, Nellore and Vizagapatam. The main drawbacks of the Cocanadas cotton as at present cultivated are its variable colour, short staple, low ginning and indifferent yield, and the Indian Central Cotton Committee is financing a scheme to remedy these defects if possible, while preserving at the same time the light pinkish colour of the lint owing to which this cotton is in great demand. As the variety is cultivated on black and red soils, the work is being carried out at two centres, viz. Narasaraopet to represent the red and light black soils and at Gurazala for black soils.

Results of recent research

Colour improvement being one of the objectives of the scheme, attention has been paid to the investigation of the limits of variation in the different standard lint grades. Progenies representing the standard grades have been tested in six agricultural research stations and it has been observed that grades 2 and 3 are not different from each other ; grades 4 and 5 are likewise similar. It has been further noticed that the lint colour is not influenced by the time of sowing and that wide variations exist in the colour of the lint produced on the same plant. Studies on the effect of exposure have shown that all grades except No. 1 deepen in colour within certain limits peculiar to each grade. These observations indicate that the colour grades are reducible to six standards made up of one white and five other progressively deepening brown tints. The three lower brown grades 2, 3 and 4 are drawn from Asiatic varieties and the two higher grades of 5 and 6 from American types. The two groups neither overlap nor merge into one another. The lint colour analysis has been found useful in the development of a dependable routine for colour classification and in the selection of progenies and plants of the required grade of lint colour.

Survey of cotton areas

A knowledge of the range of variation amongst the different characters as also the availability of the desirable combinations of these in the cotton tract being a necessary prerequisite to the work of selecting a superior type, the survey of the cotton areas in Vizagapatam, Godavari, Kistna, Guntur, Nellore and Kurnool districts and also a part of H. E. H. the Nizam's Dominions adjoining the British districts, was undertaken and a large number of samples collected and examined. The analysis of the survey collections was based on the three existing trade denominations, Red Rajahmundry, Red Cocanadas and Red Northerns. These trade groups are said to possess intrinsic differences ; Red Rajahmundry standard is of good colour but short in staple ; Red Cocanadas is stated to combine colour and medium staple ; and Red Northerns is said to have good staple but poor colour. The price differences in the market are based on the combinations of these attributes. Observations on colour indicate that heritable variation for colour is abundant in Vizagapatam and Godavari districts ; that it is less so in the districts of Guntur, Kistna and H. E. H. the Nizam's Dominions and that it is negligibly low if not entirely absent in Kurnool and Nellore districts ; but from the point of other attributes, Guntur district possesses the largest useful variation. The study of the variability of economic characters in bulks and progeny rows raised from the survey collections has revealed that (a) the lint colour is modified by change in locality, (b) the habit characters are affected more or less to the same extent in all bulks by changes in environment, (c) conjoint variability for all characters is absent in

all bulk collections (d) there is wide scope for selection of plants for individual characters like staple, ginning outturn or colour and (e) the plants with deep coloured lint have always a shorter fibre length. The data have also shown that the upper limit of improvement of lint colour in Cocanadas cotton can only be grade 2+ and that further intensification of colour should be looked for in hybridization. The major cotton area is of Red Cocanadas and geographically situated between two other less important sub-groups, viz. Red Rajahmundry and Red Northerns, and a cross between the predominant types of the extreme zones may yield suitable intermediate types for the middle zone. In addition, hybridization between Cocanada varieties and coloured non-*indica* strains is expected to result in desirable new combinations which are now absent in the bulks or the parent varieties.

A new strain

As a result of the previous work carried out by the Department, a strain known as × 20 has been evolved. It possesses a medium staple, fair ginning and good yield and is valued at about Rs. 30 on Red-Cocanada cotton although its lint colour is very much lighter than that of the average local type. The strain is adjudged suitable for spinning 29s highest standard warp counts. The results of the District trials with × 20 have shown that it is suitable for growing in the inferior white pockets of Guntur and Nellore districts, the short stapled areas of Godavari and Vizagapatam and the light coloured zones characterized by low ginning outturn in Nellore and Kurnool districts. As, however, its lint is of a light shade, it has been crossed with deeper coloured types to obtain improvement in the colour. Many of the hybrid progenies equal the best Palnad standard, which is the trade standard for colour and quality and the colour problem appears to have been solved. The next immediate problem is the selection of a cosmopolitan type with the most desirable combination of economic characters. Attempts are also being made to determine if there is any correlation between the colour of the lint and its power of absorbing dye.

MUSTARD OIL TEST FOR GHEE

SOMETIME back there appeared in Indian Farming a short note on a simple test described as the 'tile test' for distinguishing pure samples of ghee from vegetable products or adulterated ghee. The reasons for the chalky deposit in the case of vegetable products or adulterated ghee which is said to settle on the tile used were explained, and the test was condemned as unreliable.

Recently another simple method of differentiating the samples of genuine ghee from adulterated ones appeared in the press. The test has been described as follows :

Take a small cup and fill it with ordinary mustard oil. Take ½ oz. of ghee out of the quantity you want to test and put it on the surface of the oil. If it is pure ghee, it will at once go down to the bottom of the cup. In case it is altogether vegetable ghee, it will continue to float at the surface of the oil. If it contains admixture of both pure and vegetable ghee, it will take its stand somewhere between the surface and bottom of the oil, according to the proportion of the two types of ghee.

The results of the investigation carried out at the initiative of the I.C.A.R., which has been interested in evolving a quick and ready method of detecting adulteration in ghee, show that the claims made for the test are not justifiable. Although all the samples of pure cow ghee, vegetable oil, hydrogenated vegetable fats and animals body fats behaved in the manner as indicated in the test, 40 per cent of the samples of pure buffalo ghee either remained floating on the top of the oil or gave an indifferent result. In the case of samples containing mixtures of ghee and other fats, there was no clear demarcation between the fat layer and the oil, and the samples did not exhibit uniform behaviour when adulterated with different fats. Moreover, the presence of adulterants could not be detected in the sample until it was heavily adulterated, i.e. over 25 per cent. Cocoanut oil or sesamum oil and the vegetable ghee prepared from cocoanut oil sank instead of floating on the surface. Therefore, the test cannot be regarded as dependable for the detection of adulteration in ghee.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Service in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. I planted in Travancore three rice plants in a pot and manured it with mango leaves, *maroti poonaac,* ash and cowdung. I got 1,500 grains from each plant, excluding chaff. As the yield in Malabar is only 3 to 25 times the quantity of seed sown, kindly tell me why it is not possible to secure 1,500 fold yield in this area.

When the grain was ripe, I cut off only the ears with a pair of scissors, and kept the plants standing. I now notice that each tiller is putting forth a second ear ; each ear has less grain than the first ear but still a substantial number. I should be glad if information as to why, even in these days of food scarcity, (a) cultivators do not attempt, and (b) cultivators are not *advised,* to reap a second harvest from each crop.

A. There is nothing extraordinary in the yields of paddy grains obtained from the pot experiments mentioned by the correspondent. That happens in all such pot experiments where the amount of the fertilizer constituents applied is considerably higher than what obtains in actual field practice. In the pot experiments there is also the other factor that limitations of water supply are not allowed to crop in and drainage is also maintained, thus obviating the fluctuations in the level of sub-soil water that obtains in field practice.

It is no doubt possible to take a ratoon crop if irrigation facilities are available and if the proper variety is used. In fact, there is a practice round about Chingleput in south India of ratooning rice, the variety used being known as *uthiri kar.* Although the capacity to ratoon is a varietal character, it is considerably modified by environmental factors like the time of harvesting the main crop and the moisture in the soil. For instance, if the main crop is harvested when it is quite ripe and there is not much water in the soil, the stubbles do not shoot at all. To have the crop and to keep it supplied with water in tracts where water scarcity is experienced even for the normal crop will not be a paying proposition. It may, however, be possible to adopt ratooning in special tracts where favourable weather and varieties exist and where it would be uneconomic to raise any other summer crop.

The results obtained by the correspondent in regard to ratooning are no doubt possible for the reasons mentioned.

Q. White or b'eached beeswax is largely specified for face creams and other cosmetics by American and British manufacturers. India does not supply it in spite of the abundance of beeswax owing to the prevailing ignorance of the methods of bleaching. Would you kindly give me information on the bleaching and refining processes ?

A. A good method of refining and processing beeswax will be found in the *Indian Bee Journal* May-June 1942, page 75. The processes of bleaching beeswax are elaborate and cannot be recommended to a layman. For the layman the best and the easiest way to bleach beeswax is to convert it into thin sheets and then expose the sheets to the sun's rays for a suitable length of time. The sun's rays have a bleaching effect on beeswax. When sufficiently bleached the wax may be melted and mounted into any desired shape.

Q. Reference article entitled 'Tuberculosis and the urban Milk Supply' in the July 1943 issue of Indian Farming. I should like to know if the danger of the spread of tuberculosis among human beings is really serious in India, in view of the fact that milk is invariably boiled before it is used in this country.

A. There is no danger in drinking milk from infected cattle if this milk is boiled for at least half an hour in a closed vessel. Tubercle bacilli are certainly destroyed by this treatment.

There are, however, certain dangers in the use of cream and cheese which may be prepared from raw milk and also in the preparation of *dahi* which in many parts of India is made by adding raw milk to the boiled milk together with the starter.

What's doing in All-India

THE PUNJAB

By Ch. Karam Rasul, B.Sc. (Agri.), Assoc. I.D.I.
Officiating Associate Professor of Agriculture, Punjab Agricultural College, Lyallpur

The rainfall during July was generally sufficient, in August it was above average in montane and parts of submontane and Rohtak, Ludhiana, Jhelum and Lyallpur districts and generally below average elsewhere while in September it was generally below average except in montane and parts of Rohtak and Gurgaon districts where it was above average. The figures of temperature and humidity for different districts of the Punjab are not available but the observations taken at Lyallpur during the quarter under review, in comparison with the normal, are given below :

	July	August	September
Mean maximum temperature (actual)	96·6	95·7	97·3
Mean maximum temperature (normal)	101·8	97·9	97·4
Mean minimum temperature (actual)	82·6	80·9	76·6
Mean minimum temperature (normal)	82·4	80·0	74·4
Mean monthly relative humidity (actual)	74·0	79·0	76·1
Mean monthly relative humidity (normal)	64·0	71·0	65·0

Crops development

Sugarcane : The area under sugarcane is estimated at 495,200 acres which is 11 per cent more than the actual area last year and bears out the statement made in the last note. Although the area under this crop has increased due to high price of *gur* last year the crop on the whole has not made so good a growth, still the condition of the crop is 97 per cent of the normal against a 10 years average of 89 per cent.

Cotton : The estimated area under cotton in the British districts is 2,330,800 acres which is about the same as the actual area last year. Of this 726,300 acres are reported to be under *desi* and 1,604,500 acres under American cotton. The crop is reported to have been damaged by white fly, jassids and root-rot in some districts and the condition of the crop is 95 per cent of the normal.

Rice : The area is estimated at 1,095,200 acres which is practically the same as the actual area last year. Rainfall in the quarter under review was greatly in defect of the normal on the upper Chenab Canal area where lies the main rice growing tract of the province. This dearth of rain coupled with the unsatisfactory and interrupted supply of canal water adversely affected the rice crop. The attack of rice stem borer this year, though appreciable, was not so severe as last year. Rice crop transplanted early or matured early suffered the least, while the late planted crop and fine late ripening varieties the most from the ravages of this insect. The crop is reported to have been damaged in parts of Dera Ghazi Khan district also.

Miscellaneous crops : The area under sesamum has increased by 12 per cent above the actual area last year and the condition is 91 per cent of the normal. The condition of groundnut crop is 95 per cent of the normal. The *toria* crop on the Lower Chenab Canal, which contributes considerable area under this crop, is likely to be less than the normal owing to the month of September having been dry.

Prices

Taking the Lyallpur market as the basis, the prices of important crops have shown an upward trend during the quarter under review. The average price of wheat which was Rs. 9-14 a md. in July has gone up to Rs. 11-0-3 in September ; of gram in the corresponding months has increased from Rs. 8-15 to Rs. 9-9, of *toria* from Rs. 12-6 to Rs. 15-2-6 while of *gur* from Rs. 11 to Rs. 13-4. Whereas the prices of gram and *gur* have almost doubled at the end of the quarter under review as compared with the corresponding period last year, the prices of wheat and *toria* have more than doubled. The high prices of wheat and gram have immensely benefited the farming community.

Locust situation

The summer brood of locust confined its main activities to the south-eastern districts of Hissar and Ferozepur where suitable organizations were set up to fight the menace. In most of the affected localities the pest has been completely destroyed while in others the operations are still in progress. Due to effective adoption of control measures no damage to crops has been reported. Locust swarms visited Lahore district and Bashirpur sub-tehsil of the Montgomery district without doing any appreciable damage to the crop or laying eggs.

Cotton improvement

Among the breeding programme, that is underway in the Cotton Research Section, Lyallpur, for the improvement of Punjab-American cottons, reselection of 289F/43 and L.S.S. varieties figures prominently. Both of these varieties, though grown on vast areas in distinct ecological regions of the province, suffer from some defects, which require to be removed in order to increase still further their usefulness to the farmers. 289F/43 is a low ginner and so cannot command a price commensurate with its excellent technological properties. L.S.S. is a late ripening variety, is liable to be damaged from frost, if and when early frosts occur.

From 289F/43, three strains (233F, 234F and 238F) have been evolved in which the original fibre length of the mother strain has been fully maintained but the ginning outturn has been considerably increased. These reselected strains went through the yield trials in 1942-43, and the average yield of *kapas* and the ginning outturn, recorded in each of them, during that year, in comparison with ordinary 289F/43, are given below :

STRAIN	YIELD OF KAPAS PER ACRE (MD.)	GINNING OUTTURN
233F	14·83	35.4
234F	14·29	34·5
238F	13·19	32·3
289F/43	13·5	29·3

These new strains are now being extensively tested in the districts which form the natural home of 289F/43 variety and if they repeat their early performance, they will be given out to the farmers for replacing 289F/43.

Likewise, in L.S.S. five strains, resembling the original variety in habit of growth, nakedness of seeds, fibre length and ginning outturn, but definitely earlier in ripening, have been built up. Though their field performance has not been tested, judging from their behaviour in the breeding plot it appears almost certain that one or more of these will compare favourably with the L.S.S. variety and will, in due course, be able to replace it.

Fruit development

The cultivation of grapefruit has attained immense popularity in recent years, especially in the Punjab, and nurserymen are finding it difficult to cope with the demand for grapefruit plants. Although the grapefruit, on the whole, is a hardier tree than even the *malta* orange, its popularity has been delayed not because of any difficulty in growing it successfully but owing to the fact that it has taken longer to find favour with the tastes of the Indian public. Now that it has become a popular table fruit with educated classes the growers are trying hard to meet the demand. Unfortunately, however, there exist, at present, a large number of varieties of this fruit which are not of the best quality. The most popular and the best varieties are the Marsh Seedless, Duncan and Foster.

A good variety of grapefruit must have medium size, thin skin, plenty of juice, and fine grained pulp, little rag, few seeds and a proper blend of sweetness and acidity. The slightly bitter after-taste is, of course, a typical characteristic of this fruit and is the chief attraction to most lovers of the fruit. To produce this variety it is essential for nurserymen to use the right kind of rootstock for producing grapefruit plants, as it has been found that it is the rootstock which determines the ultimate quality of the fruit borne by the scion.

Experiments conducted at the Fruit Research sub-station, (I.C.A.R.), Montgomery, have shown that *kharna khatta* (C. Karna Raf.) when used as a rootstock for grapefruit (Marsh Seedless) produced vigorous trees not only bearing a heavy crop but the fruit from these trees (which are now 6 years old and have fruited for the third time) was of a medium size with the least amount of peel and a high percentage of juice. Although the percentage of total sugars in the fruit was not very appreciably increased by this rootstock the acidity remained low with the result that the blend of sweetness and acidity remained constant, i.e. it neither improved nor deteriorated.

The other rootstocks tried on this fruit were

jatti, *khatti* (rough lemon), *mitha* (sweet lime), *mokari* (citron), *nasnaran chakotra* (Pomelo) and Jullunduri *khatti*. Of all these *kharna khatta* (C. Karna Raf.) proved decidedly the best for grapefruit and is recommended to all nurserymen for the production of grapefruit trees.

SIND

By L. M. Hira
Marketing Officer, Sind

The problem of grow more food is being tackled in Sind in two ways—first by an energetic drive for increasing the production of foodstuffs and secondly by a scheme of comprehensive control of essential commodities. In regard to the former, earnest efforts are being made by the Agricultural Department to increase food production by bringing every available acre of fresh land under the plough and also by encouraging intensive cultivation, by encouraging the growth of 'two blades of grass where one grew before'. The Government have also sanctioned further liberal concessions, to be in operation for a period of two years. The campaign has yielded good results in some places, while in other places much more has yet to be achieved. It is estimated that about 20 per cent of new land has been brought under cultivation so far.

Civil supplies

The Civil Supplies Department has been dealing promptly and satisfactorily with all problems relating to food supply in the province. Effective measures to control prices of essential commodities have been taken on the one hand, and arrangements for the prompt distribution of foodstuffs on the other. A food syndicate has been established by the Government to acquire surplus stocks of essential foodgrains and arrange for their equitable distribution to people. Rationing of certain essential commodities in Karachi and three other cities is about to be brought into operation.

Desert farming scheme

The scheme of desert farming and fodder tree cultivation has started working with the appointment of a Soil Physicist. The scheme is financed jointly by the Imperial Council of Agricultural Research and the provincial Government in the proportion of 2 to 1, with a total expenditure not exceeding Rs. 35,600 as the share of the Imperial Council of Agricultural Research, spread over the entire period of the scheme, i.e. four years. The cost of buildings and wells is to be borne by the provincial Government in addition.

The scheme has been started to study the agricultural needs of the desert part of Sind, comprising four talukas, i.e. Mithi, Chachro, Diplo and Nagar Parkar, bordering south-east of Sind, with a population of 1,87,884. The tract depends entirely on rains for the green and grasses. It enjoys the maximum of rainfall as compared to other parts of Sind. Nevertheless, it frequently faces famines which are, occasionally, so very severe as to swell the death roll of livestock to 70 to 75 per cent, thus depriving the people of their best heritage.

The main object is the study of various methods of dry farming for the conservation of soil moisture, for the best and the fullest utilization of the same for successful cultivation and introduction of trees to provide shade and fodder for cattle, specially during emergency period. The aim being the elevation of economic status of the entire tract as well as making life for men and animals less severe during the unhappy years of natural calamity of famines. The main problems thus are:

(1) Conservation of soil moisture and its utilization to the fullest extent.

(2) Introduction of suitable drought resistant varieties of cereals.

(3) Growing of suitable grasses to serve as fodder.

(4) Growing of Xerophytic trees to produce shade and in emmergency cases fodder for cattle.

Export of cattle banned

The Government have banned the export of cows, bullocks, bulls, buffaloes and their young ones by rail, road, river or sea from any place within the province to any place in India except under a permit issued by the authorities. Price of milk has also been controlled and fixed at 6 As. per seer, within Karachi municipal limits.

ASSAM

By S. Chakrabarti B.A. (Hons.)
Assistant, Office of the Director of Agriculture, Assam

UNDER the stimulus of grow more food campaign, production of fresh vegetables is registering great progress. In addition to the supplies of seeds made by the Department of Agriculture, large quantities of seeds are being indented for by the cultivators through private agencies. In the Upper Assam Valley alone, the Department of Agriculture has supplied the following seeds :

Cabbage seeds	-	63	lb.	Cauliflower seeds	–	52	lb.
Carrot	,, –	23	,,	Lettuce	,, –	8	,,
Turnip	,, –	84	,,	French Bean	,, –	377	,,
Vegetable				Lofa	,, –	2	,,
Marrow	,, –	3	,,	Knol Khol	,, –	43	,,
Spinach	,, –	8	,,	Beet	,, –	11	,,
China				Garden Pea	,, –	47	,,
Cabbage	,, –	2	,,	Tomato	,, –	19	,,
Capsicum	,, –	1¼	,,	Radish	,, –	256	,,
Brinjal	,, –	5	,,	Rai	,, –	4½	,,
Onion	,, –	236	,,	Field peas	,, –	1,800	md.

The total supplies made by the Department for the whole province will be about four times the quantities mentioned above and it is hoped that the area under fresh vegetables will increase this year by something like 50 per cent. The Department is also supplying seedlings—the supply in the Upper Assam Valley up to date being about 300,000 seedlings. Cultivators are also raising seedlings for sale which will help growers to a considerable extent.

The non-cultivator classes are also taking to vegetable farming in the towns and villages and kitchen gardens are quickly becoming a common sight. This will, in its turn, not only relieve the pressure on the market for fresh vegetables but will also make greater supplies of seeds and seedlings available for next year's planting.

New bunds and dongs

One of the measures adopted by the Government for increasing the production of food is the making of *bunds* and *dongs* (dams, embankments and drains) at suitable places so as to control water supply for food crops, particularly paddy. The Hon'ble Minister of Agriculture inaugurated the making of one such *dong* at Debitola (Dhubri) on the 21 January 1944.

The Hon'ble Minister was accompanied by the Sub-Divisional Officer, Dhubri ; the Director of Veterinary Department ; Deputy Director of Agriculture, Livestock ; Assistant Deputy Director of Agriculture, Irrigation and local officers of the Department of Agriculture. As the party arrived it was greeted by hundreds of villagers who presented the Hon'ble Minister with an address to which he made a suitable reply. He particularly exhorted the villagers to put every inch of available land under food crops and not to sell their plough cattle. He was then formally requested to inaugurate the exacavation of the *dong* and he acceded to the request with pleasure by cutting the firat sod. The ceremony over, the party was treated to light refreshments.

It is estimated that on the completion of the *dong* the production of paddy in about 1,000 *bighas* of land will increase by 40 per cent and another 4,000 bighas of new land will come under cultivation.

CATTLE FAIRS IN SOUTH KANARA

By A. S. Mahadeva Ayyar
District Veterinary Officer, Calicut.

THE most important annual cattle fair in South Kanara is held at Subramanyam village, Puttur taluka. As the locality where the fair is held is called Kulgunda, it is also called the Kulgunda Cattle Fair. It is on the borders of Mysore. This village with the sacred temple of Subramanya is an attractive place of pilgrimage for Hindus. The fair, more than a century old, is held during November or December for the two weeks just before the Shashti festival of this temple.

The cattle fair is conducted by the South Kanara District Board. A sum of nearly Rs. 1,500 is spent every year for the temporary

arrangements and an entrance fee of 2 annas per head of cattle is collected. The Cattle Disease Act of 1866 is enforced during the period and a Veterinary Assistant Surgeon is posted to supervise its enforcement Act. The Health, Sanitary and other departments also participate in the fair.

The village being on the borders of the Mysore State, most of the cattle brought to this fair are Mysore breeds. About 11,000 animals are brought every year and 90 to 95 per cent of them are sold before the close of the fair. The prices of cattle fluctuate according to the demand. There is abundant grazing and splendid water close by. Almost all the cattle are purchased by the ryots of South Kanara.

Sitanadi cattle fair

An annual cattle fair is held at Sitanadi, Hebri village, Karkal taluka, on the border of Mysore State and has no historical importance. It was started only in 1937 to facilitate easy purchase for the ryots of Karkal, Coondapur and Udipi talukas. It is usually held in December, 10 days after the Subramanyam Cattle fair, and lasts for 12 days. The Panchayat Board, Hebri, was managing the fair, but now it has been handed over to the District Board, South Kanara. The Cattle Disease Act of 1866 is put into force during the fair and a Veterinary Assistant Surgeon is deputed for duty.

The cattle brought to this fair are the remnants of the Subramanyam fair and from the neighbouring Mysore State. About 2,000 cattle, mostly of Mysore breed, are brought to the fair and some buffaloes, and almost all of them are sold. A cattle show is held here and prizes are awarded for the best cattle. There is ample grazing and good river water close by.

Kizhur cattle fair

Kizhur is a village in Kurumbranad taluka in the Malabar district and as the story goes it was once ruled by the Chief of the Zamorin of Calicut. He belonged to the Adiyodi family, and used to go, at least once a month, to the Muchukunnu temple near Panthalayini to worship Siva. When he was too old and unable to go to Muchukunnu, he felt very unhappy. Siva, pleased with his sincerity, appeared before him in a dream in the form of the bull Nandi. The Adiyodi then constructed a temple there, with Siva in the form of a bull. Every December, there is a festival in the temple, when cattle fair is held for a week. It is also believed that cattle that visit the place will not have any disease.

The fair is managed by the Adiyodi family under the control of the Malabar District Board. About 5 to 10 thousand cattle are brought there from all parts of Malabar and the neighbouring districts. The Cattle Disease Act is enforced and a Veterinary Assistant Surgeon deputed for duty. This Cattle fair is very old and it is not known when it was started.

Orkattery cattle fair

This is an annual cattle fair held at Orkattery, Kurumbranad taluka for a week in January, along with the temple festival. No historical importance is attached to it. It is organized by the owner of the temple and the village munsif. This was commenced only four years ago. About 2,000 cattle are assembled here from the neighbouring talukas. The Cattle Disease Act is enforced and a Veterinary Assistant Surgeon posted for duty.

BALUCHISTAN

By M. Asghar Ginai, M.Sc.(Hons.)
Pomologist, Department of Agriculture, Baluchistan

THE Grow More Food campaign launched by the Government is becoming popular day by day. In spite of scarcity of water supply which acts as a serious limiting factor, the production of potatoes, vegetables and cereals is steadily increasing. The seed depots opened by the Agricultural Department in Jhatpat sub-division of Sibi district have distributed several thousand maunds of improved wheat seed in this growing season. Improved seed is also being grown on Government farms for use as seed in subsequent years. Schemes for the improvement of wheat and control of Bunt in the uplands of Baluchistan

are under the consideration of the Government.

Army vegetable schemes

To ensure winter supply of vegetables for the Defence Services, stationed in Baluchistan, 100 acres of land have been put under vegetables at Sibi. At Quetta another 100 acres have been earmarked for growing summer vegetables for the troops. These schemes will not only place on secure footing the vegetable supply for the military but will help to control the shortage and inflation in local markets which ordinarily occur when the supplies for the army are drawn from these markets. The Agricultural Department is helping the growers in securing better seed, cheap manure and other facilities. The manure recently prepared according to Bangalore method is being issued to zemindars from municipal dumps. Transport facilities are being arranged for the carting of manure. Recently the Army has offered 15 trucks for the transport of manure for growers. Costs are being worked out with a view to make this transport as cheap as possible.

Vegetable seed production is also attracting the attention of growers and besides Messrs P. Dagga and Co., a few other growers are taking up this work. The Quetta climate is considered very suitable for the production of seeds of cabbage, carrot, beetroot, knol khol and turnips, which ordinarily do not seed well in the plains of India. A scheme for the maintenance, proper supervision and improvement of vegetable seeds grown in the Quetta Valley has been sanctioned by the Government. The prospects for the development of this industry are very bright. The scheme will shortly come into operation.

Fruit extension schemes

Baluchistan fruit extension schemes are of special interest from development point of view under the present conditions. Under these schemes, the land and water belong to the zemindars, necessary financial help is given by the Government in the form of *takkavi* loans and the technical staff is provided by the Agricultural Department. In their first year of bearing, the two extension schemes, viz. Murtat Khurd Almond Grove (50 acres) and Mallezai Vineyard (105 acres) have done very well. About 150 md. of almonds have been picked from Murtat Khurd Almond Grove and are being brought to Quetta for sale. The current price of hard-shelled almonds is Rs. 80 per maund, and Rs. 120 per maund for thin-shelled almonds. The Mallezai Vineyard produced fresh grapes worth Rs. 6,000 and about 60 md. of raisins (*Abjosh*). The raisin industry is new to this part of the country but is coming into being, due to the propaganda done by the Agricultural Department. Several growers made raisins of their surplus grapes during this season.

At the fruit experiment station, Quetta, a large variety of fruits and stocks have been tried. Their pomological characters and commercial prospects have been thoroughly studied. The data collected is being sifted and written out. Peaches have already been dealt with and information about apricots is under publication. Selected varieties are budded from time to time and are being introduced in the country. During this season, the following varieties have been selected for propagation :

Almonds : Thick-shelled, Thin-shelled (rumali).

Apples : Golden-Delicious, Kulu, Amri.

Apricots : Charmaghze, Sardai, Nari, Large Red, Luizet, Pavoit.

Cherries : Knights Early Black, Early Rivers, Royal Ann, Fragmore, Late Black Local.

Grapes : Black Monnuka, Muscat Hamburg, Flame Muscat, Muscat of Alexandria, Flame Tokay, Black Hamburg, Ribier, Mission, Thompson's Seedless.

Nectarines : Leppiat Late Orange, Stanwick, Shaleel Local.

Peaches : Goulds Early, Early Imperial, Elberta, Parween, Curry, Dilkash, Lalarukh, Muir, Sims, Babcock.

Plums : Santa Rosa, Peach, Norman, Pearl, Victoria, Franz Joseph, Cox's Emperor, Yellow Drop.

Locust situation

Since July 1943 the locust situation in the whole of Baluchistan is calm. Ordinarily the return migration of adults into the province starts in October and continues till February, but so far no swarm has been seen. Preparations are, however, being made in Mekran to fight the pest if and when it appears. Necessary material is being stored at various places and the Government of India's technical staff have been posted at important outposts. The local administration has also overhauled its anti-locust organization and a whole-time Locust Control Entomologist has been appointed since 1 December 1943. The main work of the new Locust Entomologist will be to act as a link

between the state authorities, local administration and the locust staff of the Government of India. It is hoped that with this new arrangement the control work will be done very efficiently.

Rakhni horse and cattle show

A Horse and Cattle Show was held at Rakhni, in the Loralai district, on 1, 2, and 3 November 1943. Arrangements were made in time and the show was a great success. Cattle were brought from all parts of Barkhan sub-division, which is one of the biggest centres for breeding Lohani type of cattle. The Lohani bullocks, unlike the well-known Nari breed, are of small size, with very hard hooves. They are highly valued for ploughing in hard and stony soil and are very popular in hilly tracts. A number of Lohani bulls were purchased at the show by the Civil Veterinary Department, N.-W.F.P., for breeding purposes in Chitral.

With the exception of milch cows, majority of which had gone dry by the end of October the entries were good. Horses, young bulls and pairs of bullocks were brought in very large numbers. At the end of the show certificates were awarded to distinguished breeders and Rs. 760 were given away in prizes. Of this amount Rs. 415 were provided by the All-India Cattle Show Society for Lohani breed and Rs. 245 were given by the local administration for prizes to horses, sheep, goats and camels.

During the period under review, anthrax broke out in Barshore and Zhob Valleys and was controlled by timely segregation of the diseased animals and inoculation of others by anti-anthrax serum. Liver fluke in sheep was reported from Duki in November and that too was brought under control.

MILK RECORDING NEWS

THIRTY-THREE cows and two buffaloes completed their lactations during November 1943 under five of the Council's village milk recording schemes. The average yield for cows was 2,471 lb., the maximum was 3,934 and minimum 324 lb. The two buffaloes yielded 3,920 and 3,905 lb. The records for individual breeds are given below :

Hariana cows

Beri area, Rohtak district, Punjab : Twenty-four cows completed lactations averaging 2,909 lb. with a maximum yield of 3,934 lb. and minimum yield of 1,824 lb. Selected records are as under :

Tattoo or Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
D.G 209	Balwant S/o Sukhdev	4	31.12.42	315	3146	18
B.H. 43	Neki S/o Rupal	5	20.10.42	375	3520	18
B.H. 5	Shoeram S/o Dani	4	28.2.43	229	3108	21
K.P. 10	Ramjilall S/o Dallram	3	11.12.42	323	3934	21
R.T. 2	Hargobind S/o Ganda	2	16.2.43	254	3304	21
K.M.307	Phoolchand S/o Udmi	4	9.1.43	305	3785	16

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
K.M. 10	Amilall S/o Udmi	1	24.1.43	288	3146	17
Z.G. 3	Ahmed S/o Nazir Khan	3	21.2.43	265	3438	16
Z.G. 167	Mange S/o Chhalo	5	3.4.43	225	2944	16
S.R. 4	Nanu S/o Arjan	3	4.1.43	308	3725	23
M.W. 2	Bhagwana S/o Nand Ram	2	1.1.43	308	3168	21

Bhawani Khera area in Hissar district has been closed down and a new unit established in Rohtak. Records from this area will not be available for some time.

Murrah buffaloes

Meham area, Rohtak district, Punjab. Only one buffalo completed her lactation during November yielding 3,920 lb.

Local cows and buffaloes

Chata area, Muttra district, United Provinces : One buffalo and five cows completed their lactations under record during November. The buffalo yielded 3,905 lb. and the cows averaged 1,303 lb. with maximum and minimum yields of

1,372 lb. and 1,175 lb. respectively. Selected records are given below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
45 Buff.	Ganeshi	2	20.12.42	319	3905	20
274 Cow	Parimal	3	1.3.43	249	1357	7
47 „	Ghanturi	2	4.3.43	256	1313	7
— „	Kashiram	1	5.3.43	242	1227	8
244 „	Jorawar	4	1.3.43	245	1372	8

Local cows, Travancore

Four cows completed their lactations under record during November averaging 1,306 lb. The maximum yield was 2,383 lb. and the minimum yield was 324 lb. The records are given below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
TR.184	Goveri Amma	4	14.2.43	261	1195	—
TR.211	Poonachandran	1	25.2.43	258	2383	—
TR.245	Auchuthan Pillai	3	8.3.43	242	1323	—
TR.256	Bhagavathi	1	15.6.43	141	324	—

Sindhi

Malir area (Karachi) Sind: During September-October, the periods for which records are now available, 16 cows completed their lactations averaging 3,242 lb. with a maximum yield of 4,266 lb. and minimum yield of 1,899 lb. No cow completed her lactation under record during November in this area. Selected records are given below :

Brand and name	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
Gujar 14	Sabu S/o Jiand	—	5.1.43	294	3822	16·0
Bhoor 55	Md. Achar	—	24.12.42	280	3710	18·0
Bolan 35	Sonio S/o Ahsan	—	1.12.42	333	4266	16·0
Ludan 76	Mahmud S/o Punloo	—	16.12.42	303	3768	16·0
Bodli 99	Karamali S/o Dost Md.	—	20.11.42	317	3487	20·0
Bodli 98	Alli S/o Dhani Bux		1.12.42	310	4088	24·0
Raii 92	Izat S/o Ahmed	—	1.1.43	282	3823	24·0

FACTS ABOUT MILK

ONE pint of milk supplies seven-eighths of the calcium, over one-quarter of the protein, slightly less than one-third of the riboflavin and just over one-fifth of the vitamin A recommended for a moderatively active man. For the child the contributions are not only larger but more uniform, indicating its special value for the young. This information is extracted from a paper presented by Dr S. K. Kon (of the National Institute for Research in Dairying) to a joint meeting of the Nutrition Society and the Food Group of the Society of Chemical Industry held in London last year under the chairmanship of Professor H. D. Kay.

Dr Kon pointed out that milk occupied among foods an almost unique position in that it is a substance specifically elaborated and designed to satisfy the nutritive demands of rapid growth. One pint of milk supplies one-seventh of the adult's daily needs and one-third of a child's. While the greatest nutritive value of milk proteins is generally recognized, it is not so widely known that much of their value lies in the ability to enhance the biological value of simple vegetable foods like cereals and potatoes. Dr Kon gave the following examples :

A combination of milk and potato had a biological value of 86—as compared with 87 for milk and 71 for potato. Similarly, bread and cheese=75·5, cheese alone=75·5 ; bread alone=52. If the two are fed separately on alternate days there is no value of a supplementary relationship.—*The Australian Dairy Research, 21 January, 1944.*

The Month's Clip

THE MAINTENANCE OF SOIL FERTILITY

By E. M. Crowther, D.Sc., F.I.C.

CROPS have many needs and soils differ greatly in their resources. New forms of mechanical power and schemes of irrigation or drainage make it possible to raise the fertility of vast areas of poor land. Governments are now realizing their responsibilities for safeguarding the land and for studying the technical problems involved. The top few inches of soil, which may have taken thousands of years to form, are the most important ; the subsoil is a useful reservoir of water.

Soil formation and conservation

In cold wet regions the mineral soil is leached of bases and nutrients, and the result is Podzol soil which can be fitted for agriculture by drainage, deep cultivation and liming. In forests of the temperate zone little soluble material is lost and the surface soil develops a crumb structure. The luxuriance of tropical forests is misleading, for when this is cleared for plantations, the heavy rainfall may wash the rich film of surface soil in a few years. Terracing, silt-pitting, contour-planting, cover-cropping, selective weeding and a forestry system had to be devised to save what was left. When grass is dominant and seasonal droughts prevent tree growth, the soil receives large quantities of organic matter and the plant roots build up a highly granular soil structure fit for cereals and other drought-resisting crops. This is the famous Chernozem or black earth seen to perfection in the Ukraine. These soils will not stand continuous cereals ; rotations with restorative crops are necessary. The general remedy is to restore the balance between constructive and destructive processes by contour-ploughing, strip-farming and cover crops which anchor the soil. At still higher temperatures in the tropics, the African farmer maintained himself by shifting cultivation. His gardens were untidily cultivated by the hoe into hills or ridges and he generally mixed his crops. These practices gave protection from wash and desiccation. The fundamental problem in Africa is to intensify agriculture without endangering the soil ; the elephant grass has been planted for a few years in rotation with cotton and food crops.

Within the major world group of soils there are innumerable local varieties. When a soil survey is well advanced, the soil series becomes the basis for interpreting and correlating agricultural experience. For post-war planning we need reliable information about the actual properties and potentialities of our soils and not merely a record of their current use.

Crop rotation in Great Britain

The earliest rotations were either two-field or three-field : corn, wild grass or winter corn, spring corn, fallow. Later a root break was introduced and natural weeds and grasses were replaced by artificial grasses. The Norfolk rotation fitted in with the stable feeding of bullocks, and farmyard manure, supplemented by stable manure from the towns, became important. On the lighter soils other rotations were developed with a succession of green crops and roots folded off by sheep alternating with cereals which were undersown with trefoil. As sheep folding declined, cereals suffered from potash deficiency. In the cooler, wetter regions the rotation was lengthened to allow several years under grazed ley.

Sir George Stapledon has shown how to fit suitable leys into a wide range of conditions of soil, climate and farming systems. So far in Great Britain there have been few experiments on the effect of different rotations on soil fertility.

Plant nutrients in soils

Liebig's Law of Minimum stated that the growth of crops depends primarily on the nutrient in shortest supply. A few of the commonest causes of infertility are the following. In Great Britain the principal cause is the shortage of lime, especially in the wettest regions or where the rain is acidified by sulphuric acid from coal fires and industrial plants. To improve soil fertility coarsely-ground limestone should be applied on acid soils. The second nutrient liable to be lost through drainage is nitrogen in the form of nitrate. These losses are more

serious than the actual removal in the crops. Dung improves the physical conditions and supplies many nutrients which allow the crop to respond to further dressings of inorganic nitrogen. Phosphates are not subject to loss by drainage but they become unavailable in other ways. On neutral soils phosphates may remain available for many years, but on acid soils in wet districts the phosphates go over to inert forms. Potash is often the controlling factor for potatoes and other root and vegetable crops. Infertility is also caused by deficiencies of manganese, boron or cobalt, or excess of toxic elements such as zinc. Chemical problems involved in recognizing nutrient deficiencies are complicated. Soil analyses are supplemented by methods of diagnosis based on leaf symptoms, plant analysis and leaf injection. In periods of depression farmers on poorer soils use less and less fertilizer and this reduces productivity of the land. On the other hand additional doses of manure on well-manured land are not productive. Fertilizers should therefore be used with closer reference to the needs of individual soils.

Organic manures

Well-rotted organic material improves the capacity of the soil to hold potassium, calcium, magnesium in active and available forms. In mixed farming, much of the benefit to the soil is derived indirectly from the leys and root crops. Balance in farming may be more aptly expressed by the proportion of leys to tillage crops or by the rate at which the plough is taken round the farm than by the amount of farmyard manure produced per acre of arable land. Before the war British farmers bought in imported feeding stuffs three times as much nitrogen as in fertilizers, as much phosphoric acid as in super-phosphate and as much potash as in all potassic fertilizers. Under alternate husbandry, leys will be started with liberal supplies of phosphate and other plant foods and in turn will enrich the soil in organic matter and available nitrogen and build up its structure. In dairy farming, large amounts of nitrogen and potash are lost down the drains partly owing to the Clean Milk Regulations and partly through the separation of cow-keeping and arable farming. Even on mixed dairy farms there are few liquid manure tanks. In Denmark subsidies have been transferred from covered dungsteads to liquid manure tanks. When straw is rotted down in farmyard manure, it contains only 2 per cent of nitrogen in its organic matter and liberates it slowly and often too late. Richer manures supply more ammonia but are subject to great losses when exposed in small heaps or spread in the field. At present the problem is to utilize surplus straw. Long manure applied early and followed by extra inorganic nitrogen to the next crop offers a solution. For market gardens the straw can be rotted to compost by using sulphate of ammonia and limestone with greenstuff or organic waste. It is more profitable to apply the straw in autumn before potatoes and give the sulphate of ammonia direct to the crop than to use the sulphate of ammonia to make compost from the straw. The position is different, if straw can be rotted down with nitrogenous materials otherwise going waste, e.g. liquid manure or sewage sludge. Straw and sewage sludge have complementary properties, and they may together add to the humus supply and provide the three principal plant nutrients.

Discussion

In the course of the discussion, the Chairman, Mr H. A. Tempany, pointed out the vital importance of phosphates for tropical soils. Sir John Russell discussed the conserving power of grass, which was a prime factor in the relation of livestock to the rest of the agriculture. The figures for fertilizer consumption in different countries needed interpretation in the light of the amount of feeding stuffs given to the livestock and the way in which the feeding stuffs are used, because they also bring in much fertility. He also drew attention to the supply of phosphates, which was a key problem. Phosphate occurs only in certain limited regions, mostly owned by France and the U.S. The British Empire was badly off in this respect. In reply to questions, Dr Crowther said that a great deal of the nitrogen tied up in the organic matter ploughed into the soil was in fact lost as far as immediate utilization by the following crop was concerned. He also declared that phosphate in sewage sludge could be utilized, and preliminary experiments had shown that it is in an available form—Extract from the *Journal of the Royal Society of Arts*, 9 July 1943.

MORE MILK WITH CLEAN UTENSILS

IN the dairy farmer's problem of preventing the spoilage of milk by keeping bacteria out of the milk the utensils are the really

important source of contamination. Milk is a highly nutritious food for bacteria as well as for human beings, and the bacteria are able to grow rapidly on the moist surfaces of strainers, pails, and cans. In this way millions of bacteria may be picked up by the first milk at the next milking. Open seams, cracks, dried-on milk, commonly known as 'milk stone', make it much harder to clean utensils and remove or kill bacteria.

Here are some pointers on cleaning pails and cans, given in Special Wartime pamphlet 'Producing Pure Milk' issued by the Publicity and Extension Division, Dominion Department of Agriculture, Ottawa. First, utensils must be in sound condition, with smooth unbroken surfaces. Galvanized or wooden pails are unsuitable because the milk clings to the more or less rough surfaces, and their use leads to trouble. Open seams and cracks should be filled with solder and any rough surface smoothed off. Dried-on milk, or 'milk stone' should be scrubbed off with fine steel wool, and the utensils kept free from this condition by being washed at once after using, before the milk has a chance to dry on. Rinse with cold or luke-warm water, then scrub all surfaces with a brush—a cloth will not do the job properly. Use washing soda or other cleanser in hot water. It is better than soap and will rinse off more easily. A final rinse with clean hot water will warm up the metal of the can so that it will dry out more quickly. Do not use a cloth which may only recontaminate the utensils, but place them upside down on a draining rack to dry. A screened rack exposed to the sun is very useful to hasten drying.—*Department of Agriculture, Canada.*

WARBLE AND BUTTER

AN increase of millions of pounds of milk will be required in 1943 if a serious shortage of dairy products, particularly butter, is to be avoided.

Much of this needed increase could be provided by controlling warble or heel flies, the grubs of which, in cases of heavy infestation, may reduce the milk yield by as much as 25 per cent.

Every farmer is more or less familiar with the activities of the heel fly and its adverse effect upon milk production in spring and early summer. The damage and reduced milk flow caused by the warble grubs as they burrow through the body of the animal during late summer and winter, while less apparent, is even more serious.

It will soon be time to treat the herd for warbles and it is to the farmer's advantage to try to wipe out this saboteur. Farm labour is now at a premium, and this is one way in which an appreciable increase in production can be brought about at a very small outlay. The grubs may be destroyed either by squeezing them out by hand or by applying a suitable warble wash about the time recommended by the Provincial Department of Agriculture concerned. A supply of control materials should be obtained without delay.

The Provincial Department of Agriculture has further information on the subject, so too has the Publicity and Extension Division of the Dominion Department of Agriculture, Ottawa, which issues a special pamphlet on Warble Fly Control.—*Department of Agriculture, Canada.*

FEEDING CARE OF BROODER CHICKS

THE brooding period, that is, the first six to eight weeks of the chick's life is the most critical and requires constant attention to details of feeding and general management. Even though ideal conditions of sanitation and temperature prevail improper feeding may still bring about disaster during this period, says H. S. Gutteridge, Poultry Division, Central Experimental Farm, Ottawa. In most of the conditions it will be most satisfactory to feed a prepared starter mash, but in wartime where some essential ingredients are difficult to obtain and substitution is necessary the commercial mixed mash is a more sure source of a balanced diet than a home-mixed mash where ingredients of unknown quality and vitamin content must often be used. In addition the actual quantity of feed consumed while the chicks are small is so little that it does not pay to attempt to save money by the use of inferior mashes during this period.

A high quality starter mash should be before the birds at all times and sufficient hoppers used so that the chicks do not have to compete for feeding space. It is important also that a liberal supply of fresh water in fountains of a type which the birds cannot contaminate be available. These fountains and the mash hoppers should be set on raised frames covered

with one half inch hardware cloth so that any water or feed which is spilled goes through the wire and cannot be picked up off the floor after being contaminated with droppings. At six to eight weeks of age, depending on how well the chicks developed, a small quantity of scratch grain is fed increasing the amount slightly each day. Again, as a measure of sanitation, this grain should be sprinkled on top of the mash in the hoppers, or if the birds are outside, broadcast on the range as far as possible away from the house to avoid contaminated ground. By following carefully such a plan of feeding and feeding management strong, thrifty chicks should result.—*Department of Agriculture, Canada.*

NEW TREATMENT FOR PASTURES

THE Professor of Agronomy at the Waite Agricultural Research Institute (Professor H. C. Trumble) recently told members of the British Press Delegation at the institute of the spectacular discovery of the value of molybdenum for the treatment of pastures (says the *South Australian Advertiser*).

It had only recently become known that molybdenum was an essential element for plant growth, he said. This discovery was made known both in Russia and the U. S. A., and later confirmed at the Waite Institute by Dr C. S. Piper. Up to that stage, however, no evidence had been provided that response by pasture plants to molybdenum could be obtained in the field.

Approximately seven years ago Mr Norman Brookman, now a member of the Legislative Council, asked the Waite Institute if it would investigate poor production on ironstone country at Meadows. Investigations were begun before the outbreak of war, and had been continued until recently. It was found that the application of wood ashes at the rate of one ton to the acre produced marked increase in the growth of subterranean clover.

Following the conduct of numerous experiments to determine reasons for the beneficial effect of wood ashes, it was finally shown by Mr A. J. Anderson, of the Waite Institute, that this effect could be obtained by the application of molybdenum at the rate of 1 oz. to the acre, the cost of this application being in the neighbourhood of 1/6. The effect had been spectacular, and this result has since been repeated in Tasmania, at Canberra, and in other parts of South Australia including Wattle Range, in the South-East, and Woodside and Houghton, in the Adelaide Hills. In view of the wide geographical distribution of the responses so far obtained, Dr Trumble said later it was expected that molybdenum might be of considerable practical importance in the development of pastures in some of the higher rainfall areas of Australia generally.

Supplies of molybdenum were available in Australia, and the roasting of this material produced molybdenum oxide, a form of molybdenum which was effective under Australian conditions.—*The Australian Dairy Review,* 21 January, 1944.

New Books and Reviews

THE FARMYARD

By F. Fraser Darling (Oxford University Press and National Federation of Young Farmers' Clubs, 1943, pp. 128, 2s 6d.)

THIS book is No. 4 of a series on *The Story of the Countryside.* It deals mostly with the different breeds of English farm animals giving a brief history of their development as well as their present characteristics.

The book includes a short but very interesting section on how man became a farmer. Another chapter is concerned with the period following man's first adventures as a settled farmer, continuing through the development of numerous breeds of livestock, which is said to have been made possible in the 18th century after enclosure acts were passed in Parliament, up to the present time. Honour is paid to men like Robert Bakewell, Amos Cruikshank, the Collins Brothers, the Thomases Booth and Bates, John Ellman and others, for the important part they had in the development of many breeds of livestock in England.

Crossbreeding has been used in the development of most of the famous breeds of farm animals of England, which are now scattered widely over the world. The desired type was generally brought about by crossbreeding and rigorous selection. It was then fixed by inbreeding to effect uniformity. The attention and devotion of men like those named has brought out over the years the best that is possible by these methods. One gets the impression that in horses, more than in cattle and other farm livestock, there has been less tendency for the selection of breeding stock being based on non-economic characteristics. One must remember, however, that an English Shorthorn cow recently held the world's record for the quantity of milk produced in one continuous period of 365 days. This record was just over 41,640 lb. of milk, or an average of more than 114 lb. a day.

The considerable number of distinct and at the same time famous breeds of sheep that have had their origin in England is amazing. The author divides them into Mountain, Longwooled and Downs and other short-wooled breeds.

There are numerous statements in this book that are philosophically sound and economically practical, depending upon the application that is made of them. The author says, 'the farmer cannot farm on his affections for his animals.' He says also, 'the right way to judge a horse is from the feet upwards, just as you judge a cow from the hind end forwards.' And again, 'When times are hard, a little human concentration (in the care of the milking cows) will make up for some of the concentrated food.'

A number of excellent photographs are included showing mostly typical examples of the different breeds of pigs, sheep, cattle and horses that are discussed. The remainder show ordinary farm yards or different types of typical English farms.

The last section of this book, chapter IX, is a series of questions designed to be used, as one visits a farm, in bringing to the attention of the visitor the type and breed of livestock to be seen and whatever else may be found to constitute the farm and its operations. So much usually passes unnoticed, particularly by visitors not familiar with a farm. The author advises us that 'To get the best out of a visit.... the best way is to slip this book into our pocket and go to call upon one of our farmer friends. Let us lean upon the yard gate of the pigsty wall, look inside the cow shed and stable, and visit the fields where the stock are grazing. What can we find ?'—J.N.W.

PHALON KI KHETI OR BABOSAI

By N. T. Vyas (Leader Press, Allahabad, 1942, pp. 233, Rs. 1-10. 3rd edition.)

THE book covers in its 11 chapters all the different aspects of fruit culture and presents the importance of the fruit industry and the possibilities of commercial orcharding in India. Important items of orchard management dealing with the selection of site, cultivation, suitable layouts, manuring, methods of propagation, after-care, the occurrence of diseases and pests and their control have all been properly dealt with in a lucid and simple style.

The previous editions of the book were very

well received all over the country and it is certain that the present edition will continue to prove as useful as the previous ones. It has already been recognized as a textbook for the agricultural schools in different provinces and should prove to be of considerable value to all interested in fruit culture. It is certainly a most useful addition to the limited vernacular literature available on agricultural subjects.—S.C.R.

THE NEWSPAPER

By Ivor Thomas (Oxford University Press, 1943, pp. 32, 6d.)

A necessity of modern life, frequently taken for granted, the newspaper has yet to make its way in India. While the prevailing illiteracy of the people and the vast size of the country make for small circulations, low financial returns and comparative backwardness, it is sometimes surprising to realize that the good Indian newspapers are as good as they are. The newspaper is an important medium of adult education, and in this country where modernization, both urban and rural, requires the public to skip several generations of economic progress, the newspaper is a vital channel of ideas.

This pamphlet, descriptive mainly of British conditions, is instructive in that the tale of achievement it unfolds has many lessons for India. The prosperity of the British newspaper industry came with compulsory education and the desire for knowledge implanted in young minds by the few years' discipline at school. When education becomes compulsory in India or at least spreads down to the masses, there will be a similar opportunity for the various talents required to produce a newspaper to render a service of the highest national value. The backwardness of the Indian countryside is mainly due to the lack of enlightenment. This the modern newspaper, aided by education, can help to remove.—F. M. de M.

From All Quarters

CIVIL SUPPLY WORK IN BROACH

THE Broach Cooperative Stores Society, Ltd. was registered in 1919. The highest figures of share capital collected and sales effected were Rs. 8,970 and Rs. 28,106 respectively. On 30 June 1942, i.e. before the distribution of foodstuffs was undertaken, it had 80 members with a share capital of Rs. 2,100, a reserve fund of Rs. 2 and a deficit of Rs. 497. Now its share capital has increased to Rs. 40,310 with 400 members and it earned a net profit of Rs. 32,000 on the sales of Rs. 22,30,627. The Society is the most outstanding institution doing civil supply work in the Broach subdivision. It is running seven shops in the city and 14 in the division at talukas and other important centres.

Through the good offices of the District Magistrate, the following permits were secured and the goods procured considerably eased the food situation in the division: *jowar*, 24,813 B. md.; wheat, 5,710 B. md.; rice 8,843 B. md.; and *tur-dal* 252 B. md. Besides this, the Society obtained 1,192 bags of paddy, 258 bags of *tur-dal*, 626 bags of rice, 720 bags of salt, 310 bags of *bajra* and 840 bags of *jowar*. It purchased 10,914 B. md of *jowar*; 3,686 B. md. of wheat; 2,471 B. md. *tur*, direct from agriculturists in competition with the merchants. This brought higher prices to the producers who in normal years were robbed of their produce at low rates by the merchants and *sahukars*. It got *tur* hand-pounded and converted it into *dal* and thereby provided employment to a large number of workers.

The Society has purchased 4,000 lb. of tea from the Darjeeling Tea Chambers. Besides, the Lipton Tea Company was good enough to allot 60 lb. of tea per month per shop.

Fourteen cooperative societies were supplied with foodstuffs worth Rs. 38,602, 10 other villages were also supplied foodstuffs worth Rs. 12,036. About 18,25,154 persons, besides the purchasers of kerosene and sugar, have taken advantage of these shops. The society has been recognized as Government agent for the sale of standard cloth. The work of sugar rationing is being done by it at most of the shops.

The total purchases and sales amounted to Rs. 23,78,766 and Rs. 22,30,627 respectively. The stock on hand amounts to Rs. 2,93,450. The Society has made a net profit of Rs. 32,000.

The Haldar, Nabipur, Panoli, Kalak and Kisnad cooperative multi-purpose societies also did the work of civil supply to the extent of Rs. 33,821. The Tankaria and Gopal Mills Stores also distributed foodstuffs worth Rs. 4,852 and Rs. 12,804 respectively.

The Collector, the Chairman of the Broach Cooperative Bank and the Assistant Registrar and other officers of the Cooperative Department rendered valuable help to the institutions. —Y. T. DESAI, B.AG., M.SC., *Assistant Registrar, Cooperative Societies, Surat.*

THE FRANK J. MITCHELL PRIZE

TO mark publicly his appreciation of the completion of a piece of horticultural research of great practical importance and likely to revolutionize the mango growing industry in northern India, viz. the propagation of mango trees by budding *in situ*, Captain L. Mitchell, Director of the Indian Mildura Fruit Farms Ltd., the largest commercial fruit concern in northern India, has offered a prize of Rs. 500 to the authors of this work, i.e. Sardar Bahadur S. Lal Singh, Fruit Specialist, Punjab, and Dr. Abdul Aziz Khan, Horticultural Assistant.

Further, to perpetuate the memory of the late Mr Frank J. Mitchell, founder of the Indian Mildura Fruit Farms Ltd., Renala Khurd, Montgomery district, Punjab, Captain Mitchell has instituted a prize of Rs. 500 per annum to be awarded at intervals of one to three years, for the encouragement of further research of practical application and value, to the Punjab fruit industry.

The award will be made by a committee consisting of The Hon'ble Minister for Development, Punjab, The Agricultural Commissioner with the Government of India, The Director of Agriculture, Punjab, The Fruit Specialist, Punjab, and The Director, Indian Mildura Fruit Farms Ltd.

NEW YEAR HONOURS

THE New Year Honours list includes several names connected with service to agriculture, animal husbandry, forestry and general science :

To be Companions of the Order of the Indian Empire.

Murtough Carbery, Esquire, D.S.O., M.C., Indian Agricultural Service, Director of Agriculture, Bengal.

Sri Pattipati Hanimireddigari Rama Reddi, Indian Agricultural Service, Director of Agriculture, Madras.

Donald Bevan Sothers, Esquire, Indian Forest Service, Chief Conservator of Forests, Bombay.

To be Commanders of the Order of the British Empire.

George McIntosh, Esquire, Chairman, Dooars Planters' Association, Bengal.

James Richmond Northridge Pryde, Esquire, General Manager, The Poonmudi Tea and Rubber Company, Limited, Kullakamby, The Nilgris, Madras.

To be Officers of the Order of the British Empire.

Ivor Bull, Esquire, Coffee Planter and Member of Coorg Legislative Council.

Herbert Hawley, Esquire, F.I.C., Government Analyst, King Institute of Preventive Medicine, Guindy, Madras.

Andrew Francis MacCulloch, Esquire, F.I.C., A.M.I. Chem. E., Chief Advisory Chemist, Office of the Director-General, Indian Medical Service.

To be Members of the Order of the British Empire.

James Thomas Cox, Esquire, Officer-in-Charge, Military Farms Group, Kirkee.

Lieutenant-Colonel Haider Khan, Professor of Chemistry, Aligarh Muslim University and Officer Commanding, 2nd Battalion (United Provinces), U. T. C., I. T. F., United Provinces.

Duraiswami Narayanamurti, Esquire, A.I.I.S., A.I.C., F. Inst. P., Dr. Ing., F.N.I., Wood Preservation Officer, Forest Research Institute, Dehra Dun.

British Empire Medal

Prabhakar Manjunath Tuggarsee, Esquire, Range Forest Officer, Kulgi Range, North Kanara Division, Bombay.

Malik Muhammad Azam, Officer-in-Charge, Meat Dehydration Factory, Nowshera, North-West Frontier Province.

Sardar Bahadur

Sardar Sahib Hardev Sohan Singh Kahai, Soil Classification Officer, Sind.

Khan Bahadur

Muhammad Abdul Karim Sahib Bahadur, Assistant Conservator of Forests, Madras.

Dr Muhammad Yusaf, M.D., B.S., Professor of Clinical Medicine, King Edward Medical College, Lahore, Punjab.

Rai Bahadur

Brij Mohan Das Gupta, Esquire, Professor of Protozoology and Director, School of Tropical Medicine, Calcutta, Bengal.

Suresh Chandra Basu, Esquire, Additional Divisional Forest Officer, Chittagong, Bengal.

Pandit Tara Chand Wazir, Chief Director of Sericulture, Jammu and Kashmir State.

Rao Bahadur

Dr Raghunath Dattaji Rege, M.Sc., Ph.D., Associate I.I.Sc., Principal Agricultural Officer, Sugarcane Research Station, Padegaon (Deccan).

Sardar Sahib

Balwant Singh, Esquire, M.Sc., Agricultural Research Chemist, Military Farms Department, Lahore Cantonment.

Khan Sahib

Rafiq Ahmad, Esquire, Sub-divisional Forest Officer, Cox's Bazar South, Bengal.

Maulvi Zeauddin Ahmed, Demonstrator of Anatomy, Dacca Medical School, Bengal.

Chaudhri Nawab Ali, Assistant Registrar, Cooperative Societies, Punjab.

Khan Ghulam Muhammad Khan Niazi, B.A., Registrar, Cooperative Societies, North-West Frontier Province.

Rai Sahib

Chaudhri Bhagwan Das, Extra Assistant Conservator of Forests, Punjab.

Seth Ramnath Biyam, Chairman, Cotton Market Committee, Amraoti, Central Provinces and Berar.

Srijut Deveswar Barua, B.A., Divisional Forest Officer, Nowgong Division, Assam.

Lala Amarnath Mehra, Vice-President, Frontier Fruit-Growers' Association and Vice-President, Peshawar Municipality, North-West Frontier Province.

Thakur Ganga Singh, Artist, Forest Research Institute, Dehra Dun.

Rao Sahib

Sri Muthuswamy Sundaranathan, G.M.V.C., Lecturer in Pharmacology, Madras Veterinary College, Madras.

Hiralal Maganlal Desai, Esquire, B.Ag., M.Sc., Assistant Director of Agriculture, Poona, Bombay

Krishna Subrao Kulkarny, Esquire, B.Ag., Professor of Agriculture, Agricultural College, Poona, Bombay.

Chaudhry Shri Ram Singh, Provincial Marketing Officer (Grain Purchase), United Provinces.

Parameswaran Damodaran Nair, Esquire, Deputy Director of Agriculture, Central Provinces and Berar.

Sri Thottekat Narayana Menon, Conservator of Forests, Cochin State, Trichur.

I D R I, BANGALORE

THE Government of India have sanctioned a scheme for the Imperial Dairy Department by which the Imperial Dairy Research Institute at Bangalore will be taking two honorary research workers from July 1944 for carrying out advanced research work for a period of one year. The problems for research will be confined to those bearing on the chemistry and bacteriology of milk and milk products, technology of milk processing and manufacture of milk products and cattle husbandry and coming within the purview of the present activities of the Institute. The workers will be exempt from payment of any fees but subject to the other conditions and rules of discipline prescribed at the Institute. They will also have to make their own arrangements for boarding and lodging. The candidates will have the facilities of doing post-graduate work for the M.Sc. and Ph.D. degrees of the Bombay University and other Universities by whom the Institute has been recognized as a suitable centre for the purpose. Intending candidates, who are graduates of Indian or European Universities, and preferably with first class M.Sc. or B.Sc. Honours qualification may apply to the Director of Dairy Research, Bangalore, at an early date giving full particulars of their age, qualifications, research experience, nature of problem described to be studied, etc.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V | MARCH 1944 | No. 3

CLIMATIC EFFECTS

IN India the study of climate is of paramount importance owing to the vastness of the country and the extreme nature of the variations in different parts. In the matter of crop production, the school child knows that water is necessary for the growth of plants and sun for the ripening of cereals. Gradually a knowledge of the numerous processes involved has been built up. Within more recent years the subject of Agricultural Meteorology has begun to emerge as a scientific entity. This branch of meteorology seeks to find out and put to practical use such details as the temperature and humidity of the air within growing crops as opposed to that in the open, the temperature exchange between soil and air within such crops, the conditions under which harmful frosts are liable to occur. But what of meteorology as applied to animals ? In the case of man, a great deal is known of such matters as maintenance of the body temperature, the reactions of the body to climatic extremes, e.g. of air temperature, of how such reactions are to be controlled, of such matters as housing conditions, proper ventilation and body clothing. One knows a fair amount as to how the diseases of mankind are influenced by various climatic conditions, e.g. as regards their nature, severity and distribution. Also we know something of how these influences work, whether the working is a direct one upon the person attacked or on the parasite which may be causes of the disease or whether the influence acts in some indirect way, e.g. upon an insect transmitter of the disease in question, as in the case of malaria and human plague.

In regard to animals our knowledge is not yet developed, largely because the number of persons interested has so far been small and also probably because the acquiring of information is a slower process with animals than with plants. The branch of Biology concerned in such enquiries is called Animal Ecology, which means broadly the relationship of animals to their environment. When the particular environment in question relates to climatic or weather conditions, the study is narrower and is known as Phenology. In considering the ecology of wild animals, such as rodents, the numbers of which in a particular area may vary enormously within a decade or so, the cause of the variation may be phenological in nature, though the action may be an indirect one and due to an adverse effect of climate on some particular food supply.

With domesticated animals, we think not so much of density of population, which is a matter that can be controlled if we so desire, as of the effects of different climates on their breeding, nutrition and diseases. We cannot perhaps actually control climate, but by a thorough understanding of climatic effects we can do much to avoid pitfalls and bring an improvement to our stock. Thus, in the matter of cattle breeding we can choose the type which is most likely to thrive in the circumstances, we can do something to arrange that calves shall be borne at a season when conditions are relatively favourable. In nutrition, plants suitable to the climate of the locality will be grown, while the ration fed should be that which enables the animal to maintain or increase its weight and to maintain its productivity to best advantage at different seasons. Ill-nourished animals, especially at the growing age, are more susceptible to the effects of cold than adults or ones in good condition. It is possible that the well-known failures of cattle to do well in the more humid tracts may be nutritional in origin, but on the other hand it may be a direct climatic effect and due to the animal's inability to disperse satisfactorily the excess heat generated

within its body. This is a matter which will be probably subjected to an enquiry.

As with human diseases, many of the diseases of stock in India have a seasonal trend, in other words their prevalence appears to be governed by climatic factors. For instance, respiratory complaints, such as pneumonia of calves and goats, seem to be more prevalent in winter, worm parasites seem to do most damage during the monsoons. In the first place, the effect is probably upon the animal and one speaks vaguely of a diminution in its resistance, while in the second case the effect is upon the parasite which owing to the moist and warm conditions is enabled to develop into its infective phase. These are merely instances and our knowledge of such matters in India is almost in its infancy, hence attempts are now being made to acquire more data. Some of the advantages to be gained from this study will already be evident to the reader and the knowledge may be put to practical use. Thus some protection from the weather is necessary in parts where there is a season of low minimum temperature as in the Punjab and North-West Frontier Province, and especially where there is accompanying rain. This applies more especially, let us say, to goats, young buffaloes and young horse stock. It is less important in reasonably nourished and unshorn sheep owing to the protection from the fleece, but it may be noted in passing that care should be taken to remove the fleece only when the weather is favourable. Poultry may require some protection from the heat during the pre-monsoon season in northern India. Buffaloes require 'wallows' in which they may cool their bodies when the air is hot ; if they are not so provided, milch buffaloes fall off in production. Finally, with some bacterial diseases, such as anthrax, black-quarter, haemorrhagic septicaemia, which in certain parts of India become more prevalent with the break of the monsoon, preventive vaccination can be carried out shortly before the expected prevalence so that the good effects of the treatment may be most pronounced during the monsoon period.

USING CLEAN SEED HELPS FOOD OUTPUT

CLEAN seed means improved crops. In view of the important part food production is playing in Canada's war effort, it is more necessary than ever to make certain all seed has had a thorough cleaning and grading, so that all weed seeds, offal, light and shrunken kernels have been removed. Improper cleaning of seed is due in most cases to lack of proper sieves or screens or to faulty adjustment of the mill. The ordinary fanning mill may often be adjusted to provide a sufficiently-well graded sample under general farm conditions. It is difficult to give instructions for fitting and operating that will apply in all cases, because different samples of the same kind of seed may require different treatment in the same mill. Not only that, but the same samples of seed may require different combinations on different mills, depending on the length and slope of the sieves, the direction and violence of the shake, the strength of the air blast and the way it strikes the seed, and the rate at which the grain is passed over the sieves.

Only seed of high quality will give a good stand of plants and a good stand is the first step towards a successful crop. Also there is a definite relationship between plumpness of the seed and the size and vigour of the young plants produced. Drought and rust frequently produce much shrivelled seed which in turn produces smaller and weaker plants. Experiments and experience have indicated that the greatest yield per acre may be expected from the use of plump sound seed rather than from seed which has been poorly graded.—*Department of Agriculture, Canada.*

Original Articles

EROSION

By Sir A. Tottenham, C. I. E.
Diwan, Pudukkottai State, Pudukkottai, South India

EROSION is a world-wide problem. Europe is the continent least affected, though even in parts of Europe, for example the Russian steppes, erosion is a serious problem. In America, Asia and Africa its importance cannot be exaggerated. In regard to Africa, General Smuts has said: 'Erosion is the biggest problem confronting this country ; bigger than any politics'. The Darbar consider that in our own State anti-erosion work is more important than even medical relief or education. But, until the public have been further educated in the importance of this work, it would be hopeless to give it the priority to which it is entitled in our budgets.

Two main kinds

Erosion is of two main kinds. Erosion due to wind, and erosion due to water. Erosion due to wind is of little or no importance in our state, though there is reason to believe that in Coimbatore, and perhaps other districts of Madras, it is of much greater importance. How important it is in the U. S. A. may be learnt from the story told by Stuart Chase in that interesting book *Rich Land, Poor Land* that 'an old Nebraska farmer was sitting on his porch during a dust storm. Asked what he was watching so intently, he replied 'I'm counting the Kansas farms, as they go by.' In Pudukkottai we have to deal with erosion due to water.

This begins as 'sheet erosion', which most people would not notice at all. Layer after layer of the soil is peeled off, and finally, after less than a foot, it may be, it is gone and what the Americans call 'hard-pan' is reached, which is infertile, at all events unless it has been ploughed up, and exposed to the action of the atmosphere for some time. For the time being, at all events, the soil is devoid of plant-food. Then come gullies, small at first, increasing rapidly, and finally forming gorges, perhaps 20 ft. deep. There are such gorges in our state, for example at Ariyur vari, and Tudayamparai. As the process goes on, large areas of rock are laid bare, as can be seen at the places already mentioned, and at many others in the State, among which may be mentioned Manatturai vari (which feeds Valnad Periya Kulam) and Ponnachchikulam, both in Alangudi taluka.

The harm erosion can do

It must always be borne in mind that—apart from the serious silting up of the tanks caused by erosion—it is not a mere question of transporting soil from one place to another, where it may be equally useful. Whatever may be the nature of the silt carried by the Nile in Egypt, and some of the large rivers in China, the silt formed by erosion in our state is infertile owing to the changes in the physical and chemical structure and composition of the soil that it undergoes, when carried to any distance by water. In their book *The Rape of the Earth,* Jacks and Whyte say: 'The water breaks down the transported soil-crumbs into their constituent particles of sand, silt, and clay, thereby destroying most of the characteristic soil properties and fertility, so that even when the eroded particles are redeposited on cultivable land, they have lost much of their productive capacity'.

It is not too much to say that, unless effective measures are taken to check erosion in our state, within a measurable time—it may be a century, it may be more, or less—a very large part of the high grounds, such as are common in the Alangudi and Tirumayyam talukas (there is much less erosion in Kulattur taluka, probably owing to the fact that there is less laterite in the subsoil there and more gneiss) will have been reduced to a desert of bare and eroded rock, scarred by horrifying ravines, incapable of supporting any form of life,—human, animal or vegetable ; while all the tanks will have been silted up, and most of the

cultivable lands destroyed by the deposit of infertile silt.

All books on this subject lay stress on the fact that this artificial or man-caused erosion, as opposed to natural erosion, which is on the whole a beneficial process, is of *recent origin*. Such appears to be the case in our state. In fact, if erosion had been proceeding for any considerable period at the same pace as at present, the condition of the state would already be such as has been foretold above. The *vattam karnam* (village accountant) assured the writer that where the appalling Ariyur ravine now is, 40 years ago there was no ravine at all. That this is literally true the writer cannot guarantee, but it seems not unlikely.

Causes of erosion

What started it ? The clue may possibly be found in the following quotation from the state history: 'It may be mentioned that the Resident made arrangements for clearing the forests and increasing the cultivable area of the state. In 1826, in reply to a question of the Governor to the Raja whether the country was covered as much with woods as before, the Raja informed him that ' agreeably to his father the Colonel's (i.e. Col. Blackburne's) order, the woods had been almost cut down, and that cultivation was going on, some thin wood remaining still in some places'. The fact remains, however, that in some of the areas where erosion is worst there is still a good deal of scrub-jungle, and of course there was never high forest in Pudukkottai.

Cart-tracks are a fruitful cause of gulleying. This is mentioned by Lord Hailey in his work on Africa. In any area where erosion is in progress the process can be seen by which at first small gulleys are formed by the wheel tracks, then these are deepened, till the cart-track has to be abandoned, and another route is taken by its side, while the original track cuts deeper and deeper till a formidable gulley is formed, to grow in due course into a ravine.

Preventive measures

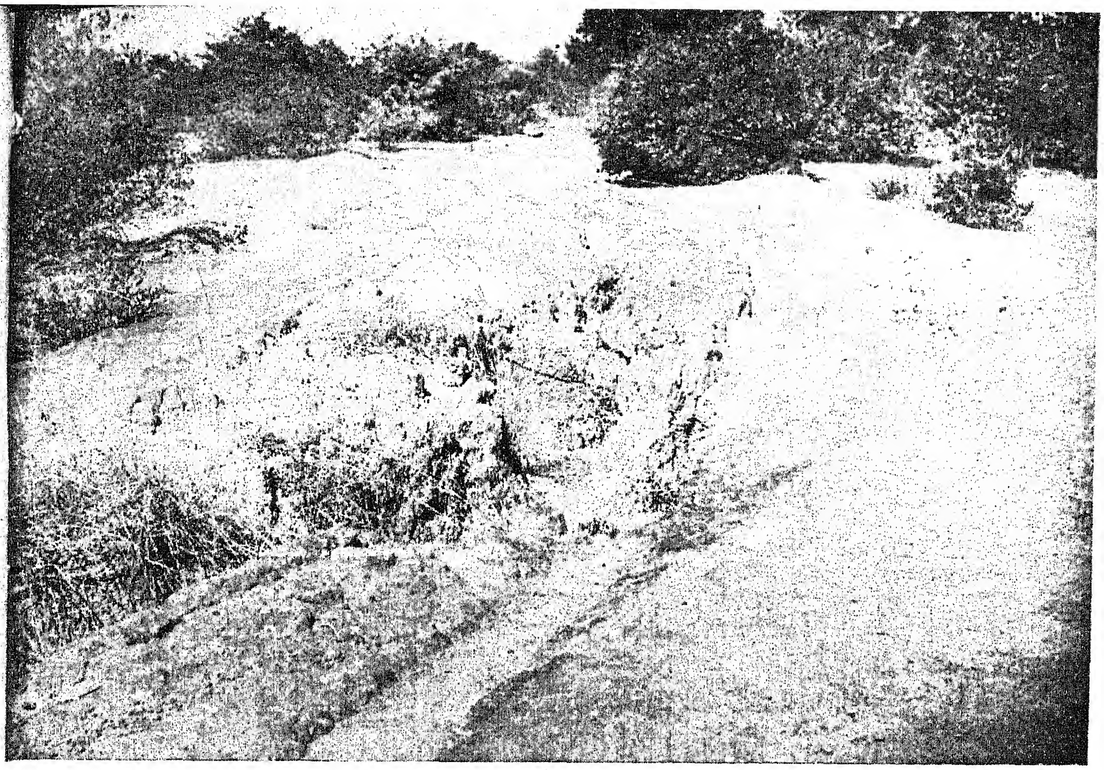
Nothing had been done to check erosion till a few years ago. Attention had been concentrated entirely on the silting-up of tanks, which it was sought to check by building expensive masonry grade-walls at the bottom of the *varis* leading into the tanks. Owing to their cost, these could only be few, whereas hundreds—nay thousands—are required. They were not particularly effective, even in stopping silt reaching the tanks. An idea was entertained that the silt deposited behind them might be removed in lorries, but of course this was never done. The cost would have been prohibitive, and it would have been difficult to find a place to dump the silt, whence it would not at once have washed down into another tank, or some cultivable fields. The problem of the rapid denudation of the uplands was of course not touched at all. It was like putting a basin on the floor to stop a leak in the roof.

Rubble dams

What we now aim at is preventing denudation and consequent formation of silt, not merely the disposal of silt after it has formed, and after valuable soil has been carried away from the uplands and defertilized. The cardinal principle that has now been adopted is that anti-erosion work must begin at the top of the eroded area, and work down to the bottom. Rubble dams have been built in very large numbers, and earthen bunds formed to check surface-wash. Dams formed of the trunks of palmyras (*Borassus flabellifer*) were tried at first, and would have been very cheap, but were not a success, owing probably to seasoned timber not having been used.

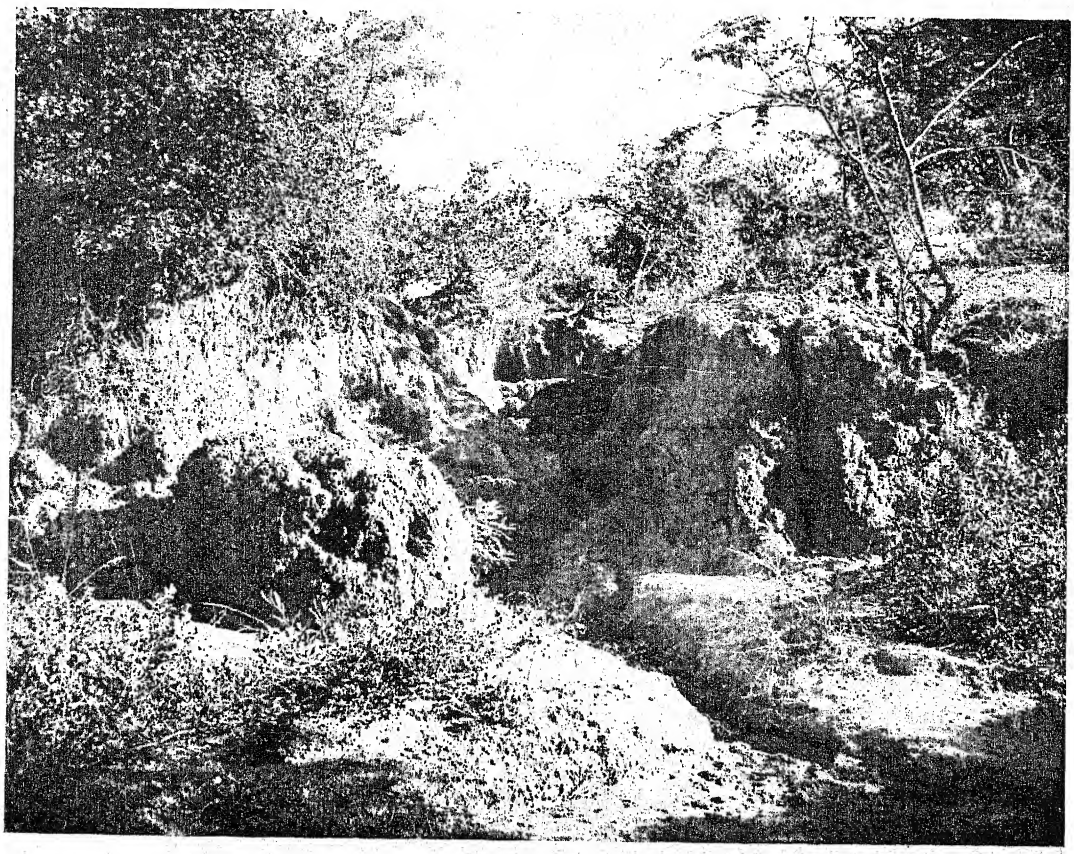
The dams we have constructed are of laterite rubble packed dry, with a top width of 2 ft. and steppings in front to a slope of ½ to 1 and in rear to a slope of 1 to 1. The bottom of the dam is taken sufficiently down not to be exposed by the slight scour that will be caused by the falling cascade of water. Connection of the dam with the side ground is made either by constructing abutments-also of dry laterite-only or wings according to the locality. Gravel is packed on the upstream face to prevent the silt running out too freely through the interstices in the laterite stones.

The distance between adjacent dams is a variable figure, depending upon the slope of the ground in the locality. It may be as low as 30 ft. in the upper reaches, and go up to about 300 ft. in the lower reaches. The position of dams is selected with reference to convenience of construction and the top of the dam is kept below the natural bed level at the site of the higher dam, allowing for a non-scour gradient.

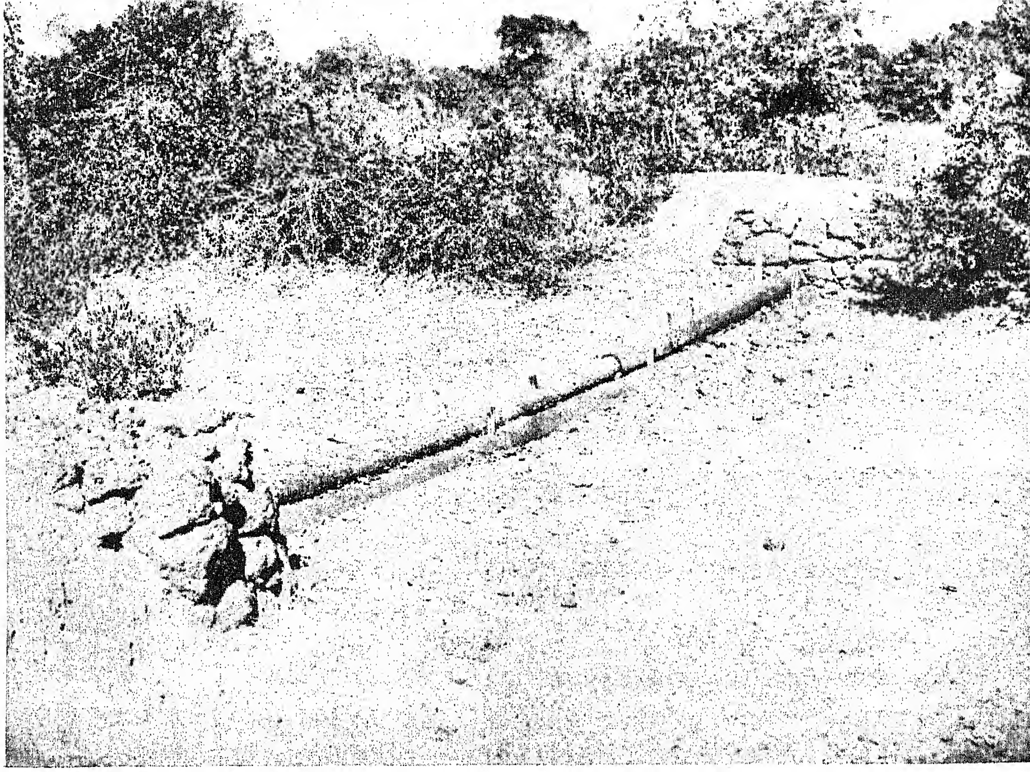


Manatturaivari. Cart tracks near dam 10 forming gullies

PLATE 12



Ariyurvari. Side gully and dam ; also showing scrub jungle



Manatturaivari. Below dam 33. Palmyra dam

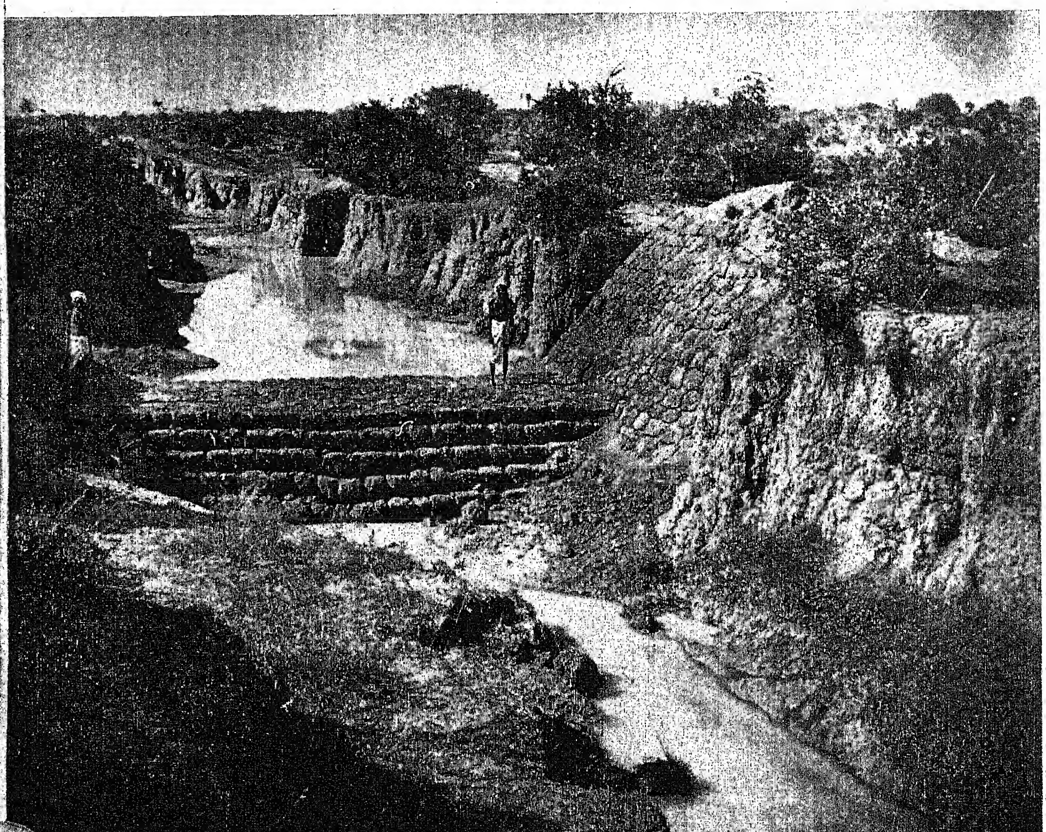
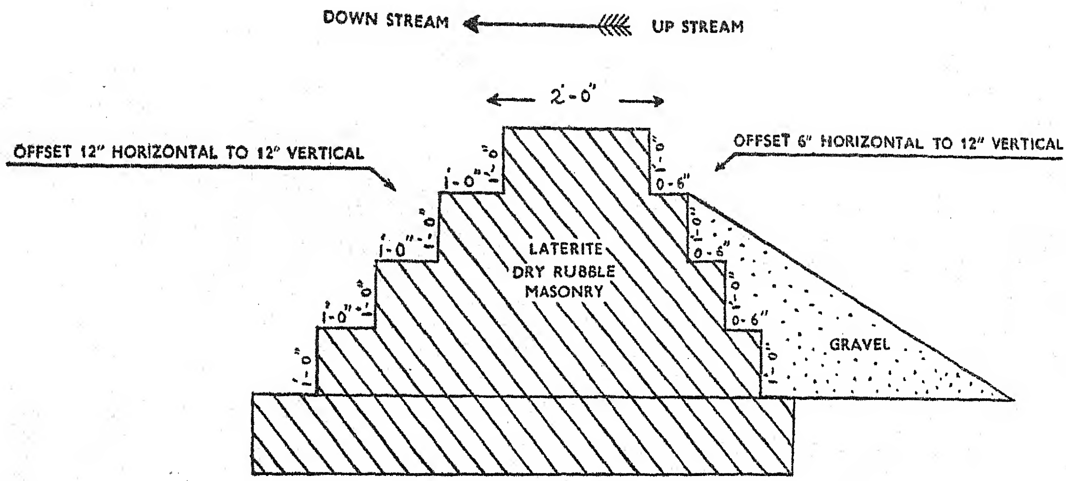


PLATE 13

Ariyurvari. View south showing dam and gorge and scrub jungle

A typical cross-section is shown below :



Experiments in grass growing

Steep banks have been terraced, and on the bunds and terraces various kinds of grass have been sown. Two African species have been tried, 'Kikuyu grass' (*Pennisetum clandestinum* which had already been cultivated at Kodiakanal, and 'Giant Star Grass' (*Cynodon plectostachyum*) which was specially obtained from Kenya and Pretoria. Various indigenous grasses have also been tried. The Kikuyu grass has not proved successful, but the Giant Star has done well in some places. Much more remains to be done in this direction.

A considerable area adjoining Manatturaivari has been ploughed with the State motor tractor, along the slope, and *Cholam* (*Sorghum vulgare*) sown. The ploughing is of course very beneficial, but the *Cholam* was sown at the wrong time and failed. Aloes (*Agave*), Cashew (*Anacardium occidentale*) and *Virali* (*Dodonaea viscosa*) are other species planted or sown. Owing to the comparatively cheap nature of these expedients, a good deal of work has been done in half a dozen places, and a steadily increasing allotment is being made for these works in the budget.

The ryots were at first by no means convinced that these works were to their advantage. They said that they were cutting off the supply to their tanks ; which in any case were doomed to destruction sooner or later, if nothing was done —a fact that they did not grasp—though actually the ultimate effect of the works must be to improve the water supply, by raising the general water-level in the upland sub-soil, while checking the velocity and reducing the violence of floods. Now, it is believed that many, even of the ryots, are beginning to see how beneficial these works are.

Persistent efforts

What the Darbar are doing at present is but little, it is true, having regard to the magnitude of the problem. Lakhs, perhaps crores, might be spent on it. That is not possible, but the Darbar consider that it is better to go on methodically, year after year doing what little they can, rather than to do nothing. They do not subscribe to the principle 'Posterity has done nothing for me, so there is no reason why I should do anything for posterity'.

The Darbar received valuable advice from Rao Sahib E. V. Padmanabha Pillai who was lent for a short time by the Madras Government to study the problems of erosion in the State, and advise as to the methods to be taken to deal with them. He wrote a useful note on the subject, which the Darbar have had printed.

THE LIVESTOCK CENSUS OF 1940

By S. K. Sen, M.R.C.V.S.
Assistant Animal Husbandry Commissioner

DESPITE the present shortage of paper leading to the holding up of important publications not connected with the war effort, the authorities responsible for the publication of the Fifth Quinquennial Livestock Statistics have done well in bringing out the document, when use can be made of it for shaping policies for the fuller exploitation of animal wealth in the postwar period and to calculate the extent of help this country with her surplus livestock will be able to offer to devastated continents.

The report, which is the fifth of its kind, presents separately for the provinces and states the numerical strength of the different species of domestic animals, including poultry, and agricultural machinery, as it stood in 1940.

Although the enumeration commenced as early as January 1940, the report was released only at the beginning of 1943 owing to the participation of a large number of Indian States in the census, the introduction of amplified classifications which greatly complicated the tabular work, and the late receipt of many of the returns from some of the Indian States necessitating reconciliation of discrepancies by prolonged correspondence.

Previous censuses

The first livestock census in British India was held in 1920, as the result of a decision reached by the Government of India in consultation with the provincial Governments to hold such enumerations every fifth year, and the Indian States were invited to join. The 1935 census marked a distinct departure from the previous three censuses in its scope in asmuchas reliable information as to (a) the number of unused cattle which the country supported at the cost of others, and (b) implements and machinery introduced in India for agricultural purposes, was made available. The special feature of this census, however, is that it presents a more complete picture by providing the additional enumeration of pigs and poultry and recording urban and rural population separately, but unfortunately these revised classifications were not uniformly adopted by some of the provinces and states, which presented their figures in the old form. In the census of 1935 two important provinces, Bengal and Bihar and Orissa, failed to participate owing to financial reasons, and on similar grounds the United Provinces and Orissa dropped out from the present census. The figures for Burma, which was separated in 1935, have been excluded. Although Baluchistan has, for special reasons, been permitted to hold the livestock census decennially along with the human population census, it has been possible to include in this report the figures for 1941. As regards Indian States, the enumeration in the present report covers about 79 per cent of their total areas as against 66 per cent of the previous census. Owing to the lack of uniformity, extensions of areas under enumeration and provinces not participating regularly, the figures set forth in the last two censuses do not represent those for the whole of India and therefore are not comparable for the purpose of reviewing the trend of animal population.

Census figures compared

For the purpose of comparison, the census figures for different classes of animals of the provinces which participated in both 1935 and 1940 censuses and the total population in Indian States are shown in Table I. The total bovine population in British India and the Indian States, as calculated from the 1935 and 1940 census reports, has declined from 208 millions to 207 millions. It will be observed in Table I that the bovine population in British India (excluding Bengal, the United Provinces, Bihar and Orissa) has dropped by about three and a half millions, while that in the States has increased by six millions. The apparent increase in the latter does not indicate an actual multiplication, because larger numbers of animals were brought within the scope of enumeration due to the extension of area.

Fodder scarcity decreases cattle population

In the usual course, however, it is only natural that, with the rapid rise in the human population resulting in further fragmentations

TABLE I

COMPARATIVE STATISTICS OF LIVESTOCK FOR 1935 AND 1940

British India (excluding Burma, Bengal, Bihar, Orissa and the United Provinces)

Cattle	1935 (in millions)	1940 (in millions)	Percentage increase or decrease
Bulls and Bullocks	22·0	21·2	–3·63
Cows	17·2	16·5	–4·06
Young stock	16·3	14·7	–9·02
Total cattle	55·5	52·4	–5·59
Buffaloes:			
Male buffaloes	2·9	2·5	–13·8
Cow buffaloes	8·9	9·4	5·62
Young stock	7·3	6·7	–8·22
Total buffaloes	19·1	18·6	–2·6
Total bovine	74·6	71·0	–3·21
Sheep	19·9	23·5	18·09
Goats	17·8	19·2	7·86
Total ponies and horses	·8	·81	1·25
Pigs	—	1·2	—
Poultry	—	30·1	—
Ploughs	11·3	11·6	2·65
Carts	3·5	3·6	2·86
INDIAN STATES			
Total bovine	54·3	60·4	11·2
Sheep	18·0	19·9	10·6
Goats	15·6	19·5	25
Horses and Ponies	·73	·71	–2·74
Ploughs	6·4	8·3	29·7
Carts	2·0	2·4	20

of holdings and extension of cultivation for food crops along the marginal areas and fallows, cattle should also proportionately multiply for meeting the extra demand for bullocks and more milk and manure, but on the contrary the number has decreased. No special reasons can be ascribed for this reduction, apart from the seasonal scarcities of fodder which occurred from time to time in certain areas, causing mortality and the regional exodus of cattle. It is rather strange that, in spite of continuous famine conditions prevailing in certain tracts of the Punjab, there has not been any marked decrease in the total bovine population in the provinces as can be seen in Table II, which gives the total bovine population figures in each province in British India from 1925 to 1940.

TABLE II

COMPARATIVE STATEMENT OF STATISTICS OF TOTAL BOVINES IN EACH PROVINCE IN MILLIONS.

Province	1925	1930	1935	1940
Ajmer-Merwara	·4	·44	·48	·19
Assam	5·7	5·6	5·9	6·4
Bengal	25·4	25·2	—	23·6
Bihar and Orissa	20·7	21·3	—	20·3
Bombay	10·8	11·7	9·9	9·7
C. P. and Berar	11·6	14·3	13·8	13·2
Coorg	·1	·1	·1	·14
Delhi	·15	·1	·1	·14
Madras	22·1	22·4	24·6	22·1
N.W.F.P.	1·0	1·0	1·0	1·0
Punjab	15·2	14·2	15·8	15·4
Sind	—	—	2·6	2·3
United Provinces	31·0	31·4	32·4	—

Economic depression affects livestock production

From the statement of mortality, as found in the annual reports of Civil Veterinary Departments, due to contagious diseases in bovines which occurred during the quinquenniums ending 1935 and 1940, it will be seen that there is no significant difference, the figures being 1·24 millions in 1935 and 1·16 in 1940. There can be no hesitation in assuming that contagious diseases played no part in the decrease. The other interesting factor, the indirect effects of which had limited considerably the normal activities of the village breeder, was the acute economic depression which swept over the remote countryside, affecting the rural economic structure and livestock industry. With the general fall in the price-levels of commodities, livestock production became comparatively uneconomic.

Economic value of sheep and goats

Sheep and goat populations show a remarkable rise, both in provinces and states. This increase may be due to the greater appreciation of these small animals by the cultivator, because of their valuable contribution towards his income. Their maintenance does not cost him anything, while in return he derives wool, meat, manure, milk and skins. Both the numbers of ploughs and carts show a definite

increase which, of course, is in proportion to the increase in human population.

Equines, on the other hand, have declined by 9·6 per cent in British India and by 1·03 per cent in the States. Obviously mechanization has been the greatest enemy of the equine species in all spheres of their utility.

Unused animals

Another interesting feature of the census of bovines is the number of unused animals over the age of three years, i.e. cattle which are not used for work, breeding or milk production. The total number of these animals for the whole of India is about 7·5 millions.

TREATMENT OF MASTITIS

IN some notes on the treatment of mastitis in dairy herds, it is recorded in the *West Australian Journal of Agriculture* that quite recently a treatment, which from the view point of efficiency and simplicity of application appears to surpass all others previously employed has been described from the United States. It consists of the injection into the affected quarter of a suspension of sulphanilamide in mineral oil. The preparation of the mixture presents some difficulties, and in order to obtain a stable suspension it has to be passed through a homogenizer. Homogenized sulphanilamide-in-oil is now being prepared in Western Australia, and may be obtained from wholesale chemists.

Highly satisfactory results have been reported in the treatment of both acute and chronic mastitis. The drug is non-irritant to the udder tissues, causing neither swelling nor pain. There is no alteration in the milk secreted, and no reduction in the milk yield. Both lactating and dry cows, may be treated. A dosage of 40 c.c. of sulphanilamide-in-oil should be injected into quarters of average size, but this may be increased to 50 c.c. if the udder is very large. This treatment should be repeated on four consecutive days, and should be carried out immediately after the morning or afternoon milking (whichever is the more convenient) after the quarter has been completely stripped out. The mixture is allowed to remain in the udder, and will be found to have been completely absorbed by the next milking. If a satisfactory response is not obtained a second course of treatment will be necessary, increasing the dosage to 80 c.c. and repeating the injections on four consecutive days.

The published reports indicate that about 70 per cent of cases may be expected to respond to the initial course of treatment ; others will require two or more courses of treatment before a cure is effected. The injections may be made by means of a teat tube attached to a syringe capable of delivering the required amount of the suspension. The udder and teats should be thoroughly washed with an antiseptic solution, and the teat orifice swabbed with methylated spirits, before the teat tube is inserted. The teat tube and syringe should be sterilized by boiling before use.

It is scarcely to be expected that the same high degree of efficiency obtained in the experimental herds will be maintained in the more severe and old standing cases encountered on commercial dairy farms. The treatment, however, is worthy of a thorough trial, and those dairy farmers desiring to employ it should consult their nearest veterinary officer. The extent to which this treatment is likely to be applied will doubtless be limited by its cost. Based on present prices the cost of the initial course of treatment is about 5/- per quarter, and for the second and subsequent courses of treatment 10/- per quarter.—*The Australian Dairy Review*, January 21, 1944.

FUMIGATION AND HEAT STERILIZATION OF INSECT PESTS

By Mohan Singh, M.Sc.(Hons.)

Assistant to the Imperial Entomologist, New Delhi

Of the methods in vogue for disinfecting plants and plant products infested with insect pests and for cleaning stores, buildings, residential rooms and other containers harbouring any dangerous pests fumigation and heat sterilization are by far the most widely recommended. For the successful employment of these methods it is essential to possess a sound knowledge of and training in the technique of their working. In order to guide workers where expert supervision is not available the following important practical suggestions are offered with the hope that they will prove helpful to them in undertaking these control operations.

FUMIGATION

Insecticides used in gaseous form for killing insects are called fumigants and fumigation is the process of exposing insects or any material infested with insects to the fumes of any chemical at a lethal strength in an enclosed space. There are a number of fumigants such as hydrocyanic acid, carbon bisulphide, methyl bromide, ethylene oxide, ethylene dichloride, chloropicrin, etc. in use for control of insects in various parts of the world. Of all these, hydrocyanic acid and carbon bisulphide and its mixtures are the most extensively used fumigants, the use of which under different practical conditions is described below.

Success in the fumigation of any enclosure or material therein depends upon the proper planning and execution of the work, careful preparation of the building and the choice of the fumigant, its lethal dose and proper time of its application. In order, therefore, to make fumigation effective it is essential that (1) the enclosure should be as airtight as possible. In most cases failure in fumigation is due to the enclosure being insufficiently airtight, (2) the temperature at the time of fumigation should be above 65°F. But in the case of living plants the temperature of the air surrounding them should not go beyond 70°F and for greenhouse plants a temperature between 58 to 68°F is ideal and it should rise slowly to prevent condensation of moisture on leaves and resultant burning by the gas. During summer, fumigation should be carried out in evenings and mornings when it is not too hot and during winter in the course of the day. *Fumigation in the presence of light causes injury to plants.*

Fumigation can be done in specially constructed chambers, bins, sealed rooms, railway wagons, warehouses, or in space enclosed by canvas tents, tarpaulins, etc. Fumigants are also used in the soil for killing the soil fauna.

(a) *Fumigation Chamber* : Where fumigation of moveable products or plants is to be carried out as a routine operation a chamber, specially constructed of plastered bricks, concrete or metal, is the most suitable enclosure. It should be situated in the open and far away from other buildings. The chamber should be fitted with a wide door on one side and a ventilating window opposite. The door and window should have the necessary fittings to make them gas-tight when closed and should open outwards to facilitate the opening after the fumigation is over. Fumigation of living plants should be avoided in strong light by fitting windows with blind glasses and for reducing the gas absorbing power of walls, ceiling and floors they should be coated with a paint or tar impervious to gas. It is convenient to have one or two pullies in the ceiling from which cyanide bags can be suspended by a string or strings fastened to the exit door through its key hole (Fig. 1). The length of the string should be so adjusted that, when the door is open, the cyanide bags suspended by the string should remain about 6 in. above the containers of sulphuric acid solution, and when the door is closed the bags should reach the bottom of the container well immersed in the acid solution. A small glass piece may also be fitted at a suitable place through which the chemical action of the fumigation materials can be watched.

Sometimes it is convenient to have a small box for fumigating small lots of material as nursery stocks, etc. The lid should be rubber-lined and made gas-tight. Sometimes boxes are used in which the edges of the lid dip into a groove filled with water. This also makes an air-tight container. It should have a small opening low down on one side through which cyanide can be dropped into the acid, after the lid has been tightly closed. Instead of the lid

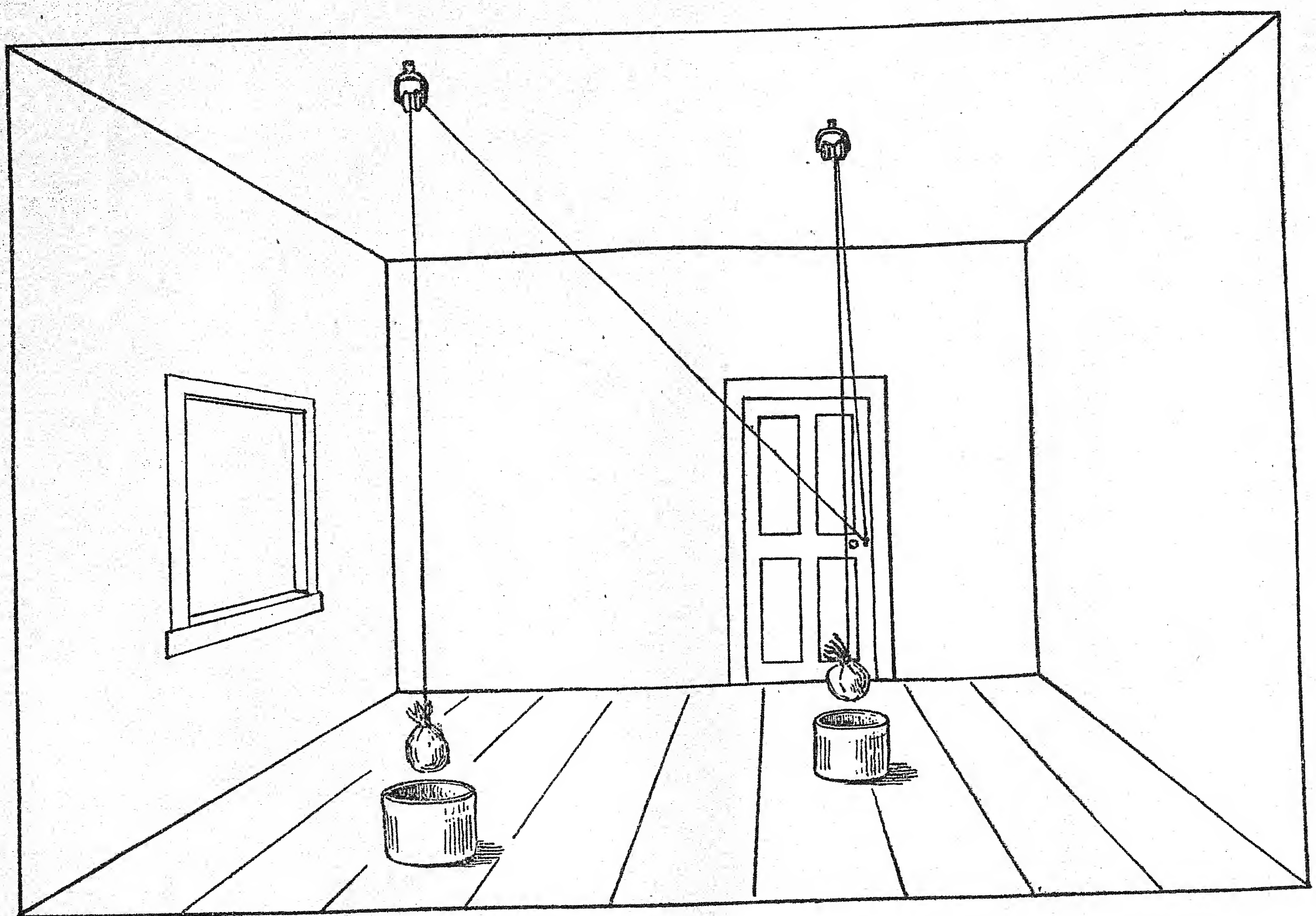


FIG. 1. Diagram to show arrangement for hydrocyanic acid gas fumigation by pot method in a specially constructed room : (A) Pot containing sulphuric acid and water mixture, (B) cyanide wrapped in paper bags, (C) pulley, (D) main door and (E) window (both capable of being closed and opened from outside).

a chimney may be provided in the centre of the top through which cyanide can be dropped. This should be closed and opened from a distance when needed. The size of the chamber or box varies according to the need, and the circumstances, e.g. from small to large fumigation chambers in which large trucks can be accommodated.

(b) *Vacuum fumigation chambers :* To ensure rapid penetration by gases, and to make fumigation more effective and to ensure thorough exposure of delicate material to gases for a shorter period, fumigation is carried out in partial vacuum chambers. Specially constructed vacuum fumigation chambers are available varying in size from a few cubic feet contents to large chambers, large enough to treat an entire railway truck. Since vacuum fumigation has not sufficiently developed on its wide use and is yet in an experimental stage in this country this method cannot be recommended at present.

(c) *Rooms, warehouses, etc. :* For fumigating articles stored in rooms against pests that may have become established therein or in warehouses, railway wagons, trucks, etc. the structure should be made airtight and all cracks and openings sealed. This can be done by (1) pasting strips of gummed papers over them. In case of thin paper more than two strips can be used if necessary, (2) plugging holes, slits, especially where corrugated iron roofs rest on walls or any other holes of similar nature, with mud or pulp made up of soaked newspapers. Cotton rags will serve the purpose in case of small holes, and (3) pasting sheets of thick paper over ventilators or such other large openings. For pasting over holes, 5 in. to 6 in. wide, a paste made of 3 parts of powdered asbestos, 1 part of calcium chloride and water enough to make it putty is reported to be excellent.

(d) *Fumigation tents :* Tents are mainly employed for fumigating orchard trees against scale or other insects. In U.S.A., South Africa, Egypt and Palestine citrus trees are often fumigated by this method. Standard sizes have heights varying from 30 to 48 ft. but the tents can be enlarged by additional strips. Canvas used for tents should be closely woven, comparatively light and of sufficient strength to stand rough handling especially when covering trees. The tents should be marked with a cross in the centre and numbers on lines radiating from this cross which would indicate the distance in feet from the cross to the point where the tent touches the ground all round the tree. The marks should be put only after the cloth has been shrunk. The amount of material required to fumigate a given tree is determined by measuring the distance over the top of the tent and the distance round the bottom. The distance over the top is measured by reading the numbers where the line touches the ground on the opposite sides of the tree. The sum of these two numbers is the distance over the top. The distance round the bottom is measured by a tape held about 3 ft. above ground. Pacing the distance around the tents is not accurate.

For the manipulation of tents two light but strong poles are used and they should be about 3 ft. longer than the height of the tree to be fumigated, the upper ends well padded with sacking, etc. to prevent injury to tent. Each pole should have a pulling rope ½ in. to ¾ in. thick and about 6 ft. longer than the poles. The rope is tied to the pole about 6 in. from the upper end by looping it over the canvas and the pole. The tent should be spread out on the ground behind the tree intended to be covered and the poles attached to the inner covers farthest from the tree. With the help of two persons for holding the poles and two for the rope, the hind end of the tent is raised and drawn tight over the tree. As far as possible tent throwing should be done against the wind. Never drag the tent over trees and when it is on the tree never pull it backwards lest any twig may get injured. Skirts on the ground should be properly tucked in. When the canvas does not lie in thick folds round the trees put some soil round the trees.

Dosage and use of various fumigants

Before determining the dosage, cubic contents of the building, room, chamber, etc. required to be fumigated should be worked out, on the basis of which the quantity of chemicals needed should be calculated. No hard and fast rules of dosage of various fumigants can be defined but in general the dosage will depend upon the nature of the material to be fumigated and the stage, status and the nature of the pest infesting the material together with the tightness of the building. Due consideration should be given to arrangements of packages and the nature of the packing material which also absorbs some of the gas. In a partly filled chamber the dose will have to depend on the actual quantity of material and the size of the room in which they are lying. Exact dose of each fumigant for a variety of

articles is given under each fumigant. Considering the variety of conditions on which depends the dosage of a fumigant the advice of an Entomologist is necessary for accurate determination.

Fumigation with Hydrocyanic acid gas

Hydrocyanic acid gas is deadly poisonous, colourless, lighter than air, non-inflammable and resembles bitter almonds in odour. The gas is fairly active above 60°F and does not injure many articles, and leaves no objectionable odour or residues. The following are the various methods of generating the gas :

1. *The pot method:* This method is the oldest and for many years has been the standard method. The chemicals used are potassium or sodium cyanide, (97-98 per cent pure) preferably the latter, and sulphuric acid. Sodium cyanide is hard, white substance, highly poisonous and hygroscopic and should, therefore, be kept at a cool and dry place. Sulphuric acid should be of commercial concentrated grade (specific gravity 1·83) and being corrosive, be handled with care. The chemicals should be used in the following proportions and always in the order mentioned below:

Water	2 fluid oz.
[1] Commercial Sulphuric acid ..	1¼ „ „
[2] Sodium cyanide	1 „ „

Vessels for generating the hydrocyanic acid gas should be of a heat resisting material such as earthenware, glass basins, chinaware, etc. Their capacity should not be less than 2½ lb. for every 2 oz. of cyanide compound. Measuring glasses for acid and water together with a balance for weighing cyanide should be ready at hand. The chemicals are mixed as follows : First the measured quantity of water is put into the pot and the quantity of the acid is poured in slowly, constantly stirring with a glass rod. Use rubber gloves when handling sulphuric acid. Before the water-acid mixture is cool and the room is ready for fumigation, sodium cyanide wrapped up in a thick envelop or bag should be carefully and slowly lowered into the vessel. Leave the room immediately, close and seal the door. If a longer delay is desired in the reaction of the chemicals to enable easy retreat two such bags, one above the other, may be used. In the absence of this device and while using thin tissue paper, etc. sodium cyanide in very small lumps may be used. But this is not very safe. In the case of tent fumigation edges of the tent should be immediately tucked down after dropping the cyanide into the acid. The man handling the cyanide or acid should avoid touching the tent and care should be taken not to splash acid on the canvas. The pot should be placed about a foot from the tree and well away from the tent.

[1] Pre-war price As. 5 per lb.
[2] Pre-war price Rs. 3-8 per lb.

After fumigation the residue left in the pot should be carefully handled and buried. Owing to certain reasons like insufficient dilution of the acid or the mixture being too cold or use of lumps of cyanide large enough for the depth of the liquid, the chemical action may not be complete and a slight disturbance may be enough to revive the action.

2. *Machine method:* On the principle of pot-method hydrocyanic acid gas is generated with the help of machines called ' Cyanofumers ' chiefly employed in tent fumigation. The machine is designed so as to deliver a definite amount of sodium cyanide solution which coming in contact with sulphuric acid from another chamber produces the required and correct amount of the gas. But as the machine is liable to leak and become inaccurate with age its use is not recommended.

3. *Dry method:* In this method calcium cyanide[3] is used which has largely replaced the pot method because of the comparative convenience and safety in its use for the production of hydrocyanic acid gas. Calcium cyanide is available in two main forms, viz: (i) 'Cyanogas', containing from 40 to 50 per cent calcium cyanide which is obtainable in granules or powder, (ii) 'Calcid' containing 88 per cent calcium cyanide and is procurable in bricks in sealed tins. The gas is liberated by thinly scattering calcium cyanide over the floor of the building, etc. or forcing it through a blower in the form of a fine dust. When calcium cyanide is thus exposed the residue remaining behind after the reaction is harmless calcium hydroxide. If the floor is wet, as may happen in greenhouses, the water should be mopped up and the material sprinkled on sheets of paper. Bricks should be broken and reduced to powder form before use.

Calcium cyanide can be used for killing scale insects, household insects, mill insects except on polished rice, and greenhouse insects.

(iii) *Liquid Hydrocyanic acid:* Liquid hydrocyanic acid stored in steel containers is pumped out in required quantity and delivered through

[3] Pre-war price Rs. 1-8 per lb.

tubes fitted with atomizer sprays into an enclosed space. The liquid almost immediately produces the gas. This method is limited to cases where large doses are needed at one time such as sterilizing big warehouses or treating citrus trees, etc. Steel HCN containers should be stored in cool place. (iv) *Zyklon :* Zyklon is only a liquid hydrocyanic acid absorbed in an inert carrier such as diatomaceous earth or crude paper discs. It is available in sealed tins. On exposure absorbed hydrocyanic acid simply evaporates in the form of gas leaving the harmless inert carrier behind ventilation, etc.

After fumigation the room and chamber etc. must be thoroughly ventilated by opening the window from outside with a long *lathi*. On a still and humid day several hours (24 to 72) of ventilation may be needed but on windy days sometimes as little as one hour may be enough. Buildings with beddings, upholstered furniture, bags or bales of products such as cotton etc. should be kept open for several hours before occupation. In case of beddings at least 24 hours exposure is necessary.

Dosage

The dosage is given in terms of the number of ounces of sodium cyanide with which the requisite amount of sulphuric acid and water will produce necessary hydrocyanic acid gas for fumigating an enclosed space of 1000 cubic ft. The quantity of sodium cyanide given under pot method together with quantities of sulphuric acid and water is for 100 cubic ft. of space. On the basis of this quantity of 1 oz. of sodium cyanide dosages for buildings with higher cubic contents can be adjusted. The following table gives roughly the amount of sodium cyanide required to produce hydrocyanic acid gas to affect kill of pests and the exposure needed :

Insect pests	Ounces of sodium cyanide per 1,000 cubic feet of space	Exposure (in hours)
Nursery plants or dormant plants in chamber	3 to 4	½ to 1
Insects infesting mills, warehouses, buildings, etc.	15 to 30	48 to 72
Stored products in general including dry fruits, clothes, books, furniture pests, etc.	20 to 40	24 to 120
Cockroaches, lice & bedbugs, etc.	15 to 20	8 to 12
Stored tobacco insects infesting :		
(i) Warehouse	20 to 40	48 to 72
(ii) Empty warehouse	15 to 30	24 to 72
(iii) Bales in chambers	95 to 100	48 to 96

When living plants are involved the concentration given in the above table should in no case be increased. Dry fruits such as raisins containing even traces of moisture should not be fumigated with hydrocyanic acid gas. Stored products in a warehouse will absorb some of the gas and the dosage should be adjusted according to circumstances. Dosage for orchard tree fumigation can be found in the appropriate charts having known the required measurements as said above.

If any method other than the pot method is employed for generating the gas the amount of the material used to produce an equivalent amount of hydrocyanic acid gas can be calculated from the equivalents given in the table below :

Sodium cyanide	Liquid hydrocyanic acid	Zyklon	Cyanogas	Calcid
1 oz.	18 to 20 c.c.	3 to 7 oz.	2 oz.	1 oz.

When using Zyklon the material should not be weighed out. An ounce refers to the weight of the hydrocyanic acid to be produced by the materials weighing about 2½ oz.

General precautions

(1) Store fumigating materials in airy, well-ventilated, cool and safe place which can be locked and sealed.

(2) Before fumigation is started make sure that the operator and any of his assistants thoroughly understand the technique and process of fumigation. Be familiar with the literature on hydrocyanic acid gas. No unauthorized person or domestic animal should be allowed in the room.

(3) When fumigating a single room or apartment, no other part of the building should be occupied by man or domestic animal.

(4) Keep the first-aid equipment ready to be used in case of accidents either due to inhaling of hydrocyanic acid gas or absorbing it through the skin, which, however, should at all costs be avoided.

(5) Washing-soda solution in water should be used at once for washing any place on the body or elsewhere where the acid might spill. Acid splashing should be avoided when mixing water with sulphuric acid and while lowering cyanide.

(6) When sealing a building make all necessary arrangements for its proper ventilation

after the fumigation; making sure that doors and windows can be opened from outside.

(7) The enclosed space should be as airtight as possible and absolutely dry.

(8) Thoroughly wash your hands after using any form of cyanide. Destroy used cyanide container or wash them thoroughly before use. Bury the residue.

(9) Keep the room, box, or the enclosure locked while fumigation is in progress. Put a warning sign at the entrance of the room 'Poison Gas—Danger' till it has been thoroughly ventilated.

Fumigation with carbon bisulphide

Carbon bisulphide[1] is one of the most widely used liquid fumigants and is available in small containers. It is a clear liquid with a disagreeable odour about $\frac{1}{4}$th heavier than water. It is highly volatile. One volume of the liquid will produce about 375 volumes of the vapour which is 2·63 times heavier than air. Its vapour is highly inflammable and explosive when mixed with air. Therefore, no form of fire should be brought near it. Lighted cigar, spark from an electric switch, etc. will cause explosion. Having the power of more diffusion through air and of going downwards its vapour has greater killing power at low levels.

The liquid evaporates fairly rapidly depending upon the area of exposed surface, the temperature of the air and of the liquid which boils at 115°F and the height of the wall of the container above the surface of the liquid.

For use carbon bisulphide should be poured into clean and shallow pans and placed on the top of the material to be fumigated. After placing the pan the operator should immediately leave the room and seal it as described in the case of hydrocyanic acid gas. To ensure rapid evaporation the liquid can be poured directly over the material to be fumigated or some absorbent material—cotton rags, etc. can be saturated and hung near the top of the room or bin. In large warehouses carbon bisulphide can be used by spray pumps in which case the operator should not stay too long in the chamber. In the case of a heap of grain more than 5 ft. in depth carbon bisulphide may be introduced by means of a pipe having openings at frequent intervals. Because of its penetrating power carbon bisulphide can be safely used for fumigating tightly packed fuzzy material where hydrocyanic acid gas cannot penetrate.

[1] Pre-war price Rs. 3-8 per lb.

Carbon bisulphide can be used (a) for insect pests of stored food and grain (seeds etc.) in granaries, mills, storerooms, etc., (b) insect pests of clothing, fabrics, furniture, in houses, warehouses, etc. (c) in the form of emulsion against soil insects and other pests in the soil, (d) for borers in the wood or trees, and (e) for bots and intestinal worms in the stomachs of animal in gelatine capsules.

Carbon bisulphide cannot be used to treat growing plants. *Owing to the ill effect of carbon bisulphide vapours upon heart action persons having any heart trouble or weakness should not attempt to use this gas.* It is unwise to treat moist seed or planting seed of any kind during periods of very humid atmosphere as the seeds are liable to get injured.

Dosage

The dose of carbon bisulphide depends to a large extent on the gas absorbing power of the container. In estimating the dosage both the quantity of the grain and the total cubic contents of the container not occupied by the grain should be kept in view. Where there is sure to be leakage the dose may safely be increased. The following table gives the amount of carbon bisulphide necessary for 1000 cubic ft. of space and the exposure needed :

Description	Carbon bisulphide to be used (in lb.) for 1,000 cubic ft. of space	Exposure (in hours)
Hermetically sealed empty metal tanks	5	24 to 36
Brick bins	8	– do –
Under tarpaulins or less airtight rooms etc.	12 to 20	– do –
One ton of grain (on quantity basis)	2 to 3	– do –
Small quantities of grain as seeds in small jars etc.	1 teaspoonful (1 drachm) for each cubic foot of space	– do –

Provided the strength and period mentioned are not exceeded no harm will be done to the grain either used as food or for seed purposes or any other material. The chemical, if pure, being wholly volatile does not leave any stain nor injure even fine and delicate fabrics. It does not affect the edibility of the foodstuff on which it is poured and all traces of the odour disappear quickly upon full and free exposure

to air. The ordinary commercial carbon bisulphide may leave some yellow stains and should, therefore, be avoided while fumigating goods that would show stain or food material.

The fire risk involved in the use of carbon bisulphide can be slightly reduced by adding 1 part of carbon tetrachloride to 3 parts of carbon bisulphide by volume. The efficacy of the fumigant mixture is directly proportional to the quantity of carbon bisulphide it contains. A mixture containing 20 per cent of carbon bisulphide is one-fifth as toxic as pure carbon bisulphide.

Fumigation with ethylene dichloride

The ethylene dichloride-carbon tetrachloride mixture is a non-inflammable fumigant that can be used with safety in situations where it is not desirable or possible to use carbon bisulphide. The mixture is made up of 3 parts of ethylene dichloride and 1 part of carbon tetrachloride[1] by volume. Ethylene dichloride is an active ingredient of the mixture, carbon tetrachloride being used to render the fumigant inflammable. The mixture is about one-fifth as toxic as carbon bisulphide and the dose should be increased and adjusted accordingly.

The mixture is stored in ordinary cans or tins and is used simply by pouring it directly over the material to be fumigated and allowing it to vaporise. Forced circulation of air over the liquid is essential since it evaporates slowly.

Since it affects paints and varnishes, its use on such articles should be avoided. It should not be used on growing plants but it does not injure the germination capacity of seeds. Food substances, rich in fat, tend to absorb appreciable amounts of the gas and, consequently, require long exposures to air to remove taint and gas is said to leave disagreeable flavour in tobaccos.

HEAT STERILIZATION

Heat is the oldest and one of the most satisfactory methods of sterilizing various products infested with insects. High temperatures are employed against insects of stored cereals and pulses; fruit-flies in fruits, insects infesting household material such as clothing, bedding, baggages, bales of cotton, etc. and the insects infesting soil. Heat may be derived from hot air, steam, electricity or the sun. Insects die within 10 minutes when exposed to temperature of about 145°F. If the temperature is low proportionately longer exposures are required. The rate of heat transfer being slow the products to be heated should be spread out in thin layers. In oven heating small quantities of the materials should be placed in pans not more than 2 in. deep. A gas oven with the fire as low as it will burn well will heat the surface of the material to as high as 180°F in 15 minutes. The centre of the material will then have reached only 120°F. At this point the heat should be turned off and the material left in the oven with the door closed for an hour. Frequent stirring will give more uniform heating and will reduce the possibility of scorching the material. In applying heat to bales or piles of goods etc. it should be remembered that it requires a long time for the heat to penetrate and therefore, the temperature on the surface reaches the killing point long before the insects within the material get affected.

Any type of machine that will keep the material in constant motion and heat all portions equally is satisfactory. The product should pass from the sterilizer directly to the packer and there should be no chance of any stage of insect being present at this time and if packed and sealed properly it should be permanently free from insects.

Electricity: An electric treatment involves the passages on conveyor belt through a high frequency and high potential field. As the electricity passes through paper with little interference it is possible to do away with the possibility of all insects entering the material between the time of sterilization and sealing of packings by exposing the sealed packages in this manner.

Steam: Dry heat being injurious to fruits and vegetables which get damaged if exposed to even 110°F steam can be more successfully applied. In this treatment steam is applied in such a manner as to secure its uniform distribution of the heated air when introduced into the heating chamber so that it does not discharge directly on the fruits. The air temperature should not exceed 112°F in any case. In fact the higher the humidity the more effective results are obtained.

Exposing or spreading any material infested with insects to the rays of the sun during hot months of the year for about 4 to 6 hours will disinfect and sterilize the material. Sunning of the grain and clothings etc. once or twice a year will ensure protection against stored grain and other household insect pests.

[1] Pre-war price Re. 1 per lb.

OX WARBLE-FLY IN INDIA

By

B. N. SONI, B.Sc.(EDIN.), *Assistant Research Officer*

and

M. A. KHAN, G.V.Sc., *Research Assistant*

Imperial Veterinary Research Institute, Mukteswar

UNDER a scheme of research financed by the Imperial Council of Agricultural Research, the ox warble-fly (*Hypoderma lineatum*) has been a subject of special study at the Imperial Veterinary Research Institute, Mukteswar, from 1937 to 1941. As a result of this study considerable knowledge has been acquired about the geographical distribution, seasonal occurrence, life-history and control measures under Indian conditions of this parasite. From the economic point of view, the destruction of this parasite is of paramount importance to the hides and skins industry of this country. The damage caused by this pest plays a very important part in depreciating the value of Indian hides when they are graded for shipment to foreign countries. The economic loss to the country resulting from this may be realized from the fact that India is responsible for about one-third of the total world production of hides and goat-skins, and is in a position to spare a big surplus for export. It is believed that on a conservative estimate an annual loss of nearly $1\frac{1}{2}$ crores of rupees occurs due to the injury caused to hides by the perforations made in the skin by the maggots of the warble-fly.

Extent of damage

People most seriously affected by the damage caused by the warble-fly are the hide merchants. With its vast resources for the production of hides and goat-skins, India can not afford to lag behind other countries in this lucrative industry. Yet Indian hides, subjected to critical judgement in international markets, can command only low prices or may be even totally rejected on account of their poor quality. The urgent need for effecting an improvement in this industry by raising the quality of raw stock was early recognized by the Government and in 1929 a committee was appointed to enquire into the causes of the common defects in Indian hides and goat-skins and suggest means for their elimination. In their report the committee remarked: 'We have treated the life-history of the warble-fly and the damage it causes in some detail, and we think it is one of the more important problems affecting hides and skins'. In the same report it is also stated: 'This pest has been rightly called the bugbear of the hides and skins trade and the tanning industry.' It is not peculiar to India but is found in many other countries, e.g. Russia, Siberia, Northern China, Mongolia, Hawaii, North Africa, South-Western Asia, Brazil, etc. Europe and America are not immune from it, even today the problem is serious enough in many of the European countries. The enormous extent of the recurring loss caused by it has been responsible for considerable research in various European and American countries. Under a preliminary trial a small scheme of control experiments on field scale has already been undertaken with a view to launching a large-scale campaign of control measures in the event of the preliminary results being encouraging.

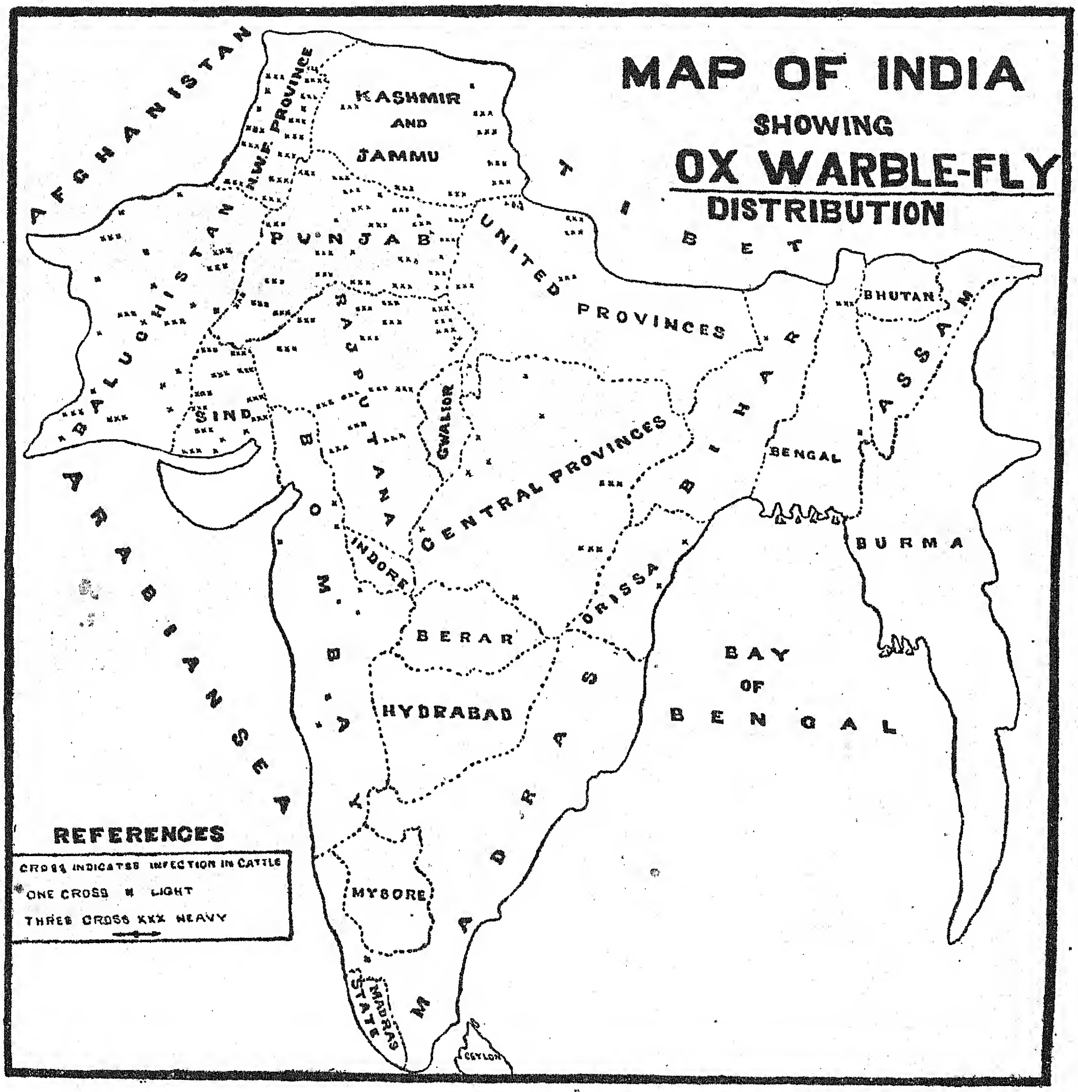
The Indian farmer who is not interested in the hides and skins of his livestock may perhaps be indifferent to the losses sustained by his countrymen who deal in hides; but he would feel more concerned if he were only to realize that his warble-affected cattle suffer from loss of condition and a diminution of milk yield during such time as the grubs of the fly are lodged in cysts under the skin of the animal's back.

Recent researches at Mukteswar have also shown that cattle, during the early stages of infection when the young larvae are found under the lining of the gullet, suffer from bleeding and obstruction of the gullet wall.

Another individual whose trade is affected by this pest is the butcher. The occurrence of full-grown warble larvae in the muscular tissues of an ox or a goat produces large pus cavities, which give a very repulsive appearance to meat necessitating its rejection.

Geographical distribution

As a result of a survey carried out it is now



known that the ox warble-fly is widespread in North-Western India including Western U.P., the Punjab, N.-W.F.P., Sind, Baluchistan, and Rajputana and absent from the moister areas, i.e. Madras, Assam, Burma and Ceylon. It has been stated: 'It seems probable that *Hypoderma* the common European genus, is confined to Western India from the Punjab southward probably as far as Gujarat.'

In certain parts of the Punjab, Sind and North-West Frontier Province the extent of infestation among cattle has been from 50 to 90 per cent. Observations recorded in November 1941 showed that, in certain tracts of Rajputana, all the cattle in certain herds were infested. From the data collected in these localities, it is evident that the pest is much more widespread there than has been generally known. The number of warble tumours observed has not infrequently ranged from 100 to 150 on a single animal.

The distribution of this pest in the Himalayas is of considerable interest. The heaviest infestation in the Himalayan range has been recorded in cattle from the Garhwal and Kumaun hills, where nearly 50 to 60 per cent of the hill cattle showed warble tumours. It is interesting to note that the cattle of Bengal hills showed

20 to 30 per cent warble infestation, though there was no evidence of infestation in the adjoining plains. In America no special correlation has been found between altitude and the abundance of grubs but it has been noted there that they seem to thrive admirably in fairly high altitudes. This is specially true with ox warble-flies which is known to be abundant at elevations above 7,000 ft.

Although the ox warble-fly is particularly prevalent in North-Western India, cases of light and rare infestation have also been recorded from eastern and southern tracts of the country. In the South rare occurrences have been observed in certain parts of Central Provinces and Bombay. A few cases have also been recorded in Ootacamund in Nilgiri Hills. The map on page 119 shows the present geographical distribution of ox warble-fly.

Life-history

The adult male and female flies are on their wings during the summer, from March to early June. Average longevity of the adult fly varies from 10 to 12 days. Its mouth parts are rudimentary and it has never been seen to feed. The life of the adult fly is devoted entirely to the labours of procreation. The male often dies soon after mating. The female has been observed to lay eggs on the second and fourth day after emergence. It approaches the animal, alights on the ground close to it and gets on to the hind legs by a series of short flights. In several cases it has been observed to deposit eggs on cattle in recumbent position.

The eggs are seldom, if ever, laid in the region of the back where the warble tumours later appear. In the majority of cases observed the seat of egg-laying is restricted to the lower portion of the animal's legs. The eggs are attached to the hair in rows of 5 to 20. The usual incubation period on the host, as reported by various authorities, is three to six days, depending upon the environmental temperature and humidity.

The eggs give rise to tiny larvae adequately equipped with mouth-parts suited for cutting and boring into the skin. The young larvae is creamy or dull-white in colour and densely covered with spines on all segments, which are 11 in number. It crawls down the hair and bores into the skin, thus causing a considerable amount of irritation and annoyance to the animal. As a result of this irritation the infested animal has a tendency to lick its legs and some of the larvae pass into the gullet and settle down there. These larvae develop in size here and have been found to die and degenerate after a period of six to eight months from the date of entry into the gullet. A large percentage of the larvae which have escaped from being licked by the animal find their way by penetration, into the muscular tissues of the animals. After wandering through various tissues of the host body for a period of nearly six to seven months, these larvae in their second stage reach the subcutaneous tissues of the animal's back. Each of the larvae with the help of its mouth parts, bores a hole in the animal's skin for its own respiration and brings its posterior breathing poles (spiracles) in contact with this hole. During a period of three to four months during which the larva develops under the subcutaneous tissues of the animal's back, it undergoes two moults and finally develops into a full-grown larva, which is barrel shaped, dark-brown in colour with a fully developed spiny armature all over its body, degenerated mouth parts and well developed posterior spiracles. A full-grown or mature larva wriggles its way out from the animal's back through the hole formed for its respiration. A heavily infested animal thus acquires a permanent damage due to a large number of holes in its skin which will finally result in the production of a poor hide.

The mature larva, after escaping from the back of its host, drops to the ground where it pupates for a duration of nearly six weeks, depending upon the variations in environmental factors, such as soil-moisture and temperature. The pupa is jet-black in colour and, as in the case of cyclorrhaphous insects, is quiescent. The adult fly emerges from the puparium usually in the morning. The pupa apparently is fully mature sometimes before it emerges and, with the aid of a relatively large balloon-like structure on its head, forces the cap off the puparium. It then crawls out and immediately begins to unfold its wings and, after copulation, is soon able to fly about its business of egg laying.

Control methods

The control of ox warble-fly may be considered under preventive and dressing methods. Preventive methods involve the use of fly repellants and the destruction of eggs by singeing. Experiments conducted for the use of fly repellants have shown little promise of success

in India or abroad. Destruction of eggs by singeing has been tried on a field scale in selected areas in the Punjab. The singeing apparatus consists of an iron rod of about 4 ft. in length bent in the form of a loop at one end and with a slit at the other. The loop serves as a handle, while through the slit is inserted a piece of coarse cloth, which is wrapped round this end in a number of layers. This end of the rod is then soaked in mustard oil and ignited. After it has burnt for a short while, the flame is put out and the smouldering torch is applied to the hair on the entire length of the legs. The singeing is done on each animal at intervals of five days.

With regard to dressing methods, trials carried out in the laboratory and on a field scale have indicated that tobacco-lime infusion and derris soap wash are the two larvicides best suited for use against ox warble-fly infestation in this country. Experiments with these dressings were therefore carried out with the object of finding out (1) their relative larvicidal values, (2) the suitable time for treating warble tumours, (3) the suitable interval between two successive dressings, and (4) the number of dressings required in a warble season as judged by the number of warble 'crops' appearing at different intervals. The two dressings were prepared as follows :

Derris soap wash
Derris powder containing soap 1 lb. (as made by Messrs Bugges Insecticides, Ltd., London)
Water—1 gallon

The powder is first put in some suitable container and water is gradually added to it, stirring the whole mass vigorously until a smooth paste is obtained and then the remainder of the required water is added. Experience has shown that neglect of these details may result in the formation of small lumps of derris powder in the suspension.

Tobacco-lime infusion :
Tobacco dust—4 lb.
Lime—1 lb.
Water—1 gallon

Tobacco dust with lime mixture is soaked in water for 48 hours and stirred occasionally. The infusion is then wrung out through a piece of coarse muslin.

For applying the dressing to the back of the infested animals a special type of brush has been devised which is shaped like a tooth brush, is $6\frac{3}{4}$ in. long and provided with a strong wooden handle. By proper manipulation of the brush, the dried exudates round the larval hole should be effectively removed so as to make sure that the dressing when applied reaches the larva contained in it.

Considering the fact that both tobacco dust and lime are easily obtainable and cheaper than derris powder, tobacco-lime infusion has obvious advantages over derris for use in this country. The drawbacks in the use of tobacco-lime infusion are the difficulty in carrying about the infusion from one place to another and the time required in the preparation of the infusion. These difficulties could be avoided if centres for the treatment of warble-fly infestations are established in groups of two or three villages under the supervision of the provincial veterinary departments.

Dressing

A convenient and safe method of dressing animals on large farms for warble-fly is to drive them into enclosures provided with a crush at the exit. Animals are then made to pass through the crush one by one and dressed by two persons working on either sides of the animal.

Warble larvae have often been observed to appear in the back in four successive 'crops' at intervals of approximately 30 days, extending over a period of nearly four months, commencing from early November in the hills and from early October in the plains. A proportion of the animals may, however, show only one or two crops. The number of dressings necessary would obviously depend upon the number of crops appearing in the back. A period of one month has been put down as a stable interval between two successive dressings. The dressings should be carried out atleast a week after the first appearance of a warble tumour, so as to allow sufficient time for all the expected larvae of the batch to appear on the back.

CULTIVATION OF *PAN* IN SYLHET

By S. Chowdhury
Plant Pathological Laboratory, Sylhet, Assam

PAN (*Piper betle*, Linn.), a perennial dioecious creeper belonging to the family *Piperaceae*, is cultivated in certain areas in India for its leaves. It is probably one of the most important garden crops in India and also one of the most profitable of all cultivated crops. In the district of Sylhet it is grown by a community of people, called the *baruis*, with whom its cultivation is a hereditary profession.

The kind of *pan* grown by the *baruis* is known in commerce as the *Bangla pan* and the area under it, at present, in the district of Sylhet is about 680 acres.

Soil requirements

High land above inundation level is necessary as excessive moisture is most injurious to the crop. Black friable clay loam resembling tank earth, containing a large proportion of organic matter is the most suitable for the purpose. In the district of Sylhet the largest number of *pan borojes* is found along river banks. This is probably due to the following reasons: (i) The soils along river banks are naturally more fertile and friable than the ordinary arable soils; (ii) river bank soils get easily drained; (iii) earthing up of *boroj* can be done easily every year with fresh silt deposits from river beds, rich in plant food materials; (iv) it is easier and cheaper to transport bamboo, thatching grass, oilcake etc. by river; and (v) irrigation can be done easily and at less expense.

Varieties

There are three main varieties: *parua*, *puathi* and *sanchi* or *chandana*. *Sanchi* is characterized by its fine sweet flavour which is not found in any other variety. The leaves are considerably longer than their breadth and dark green in colour. The stem and the petiole are blackish green.

Puathi has its stem slightly reddish and the petiole light green in colour. Leaves are large, cordate and light green in colour. The petiole attains considerable length.

Parua has its stem and petiole of the same colour, light green. Leaves are large, cordate and light green like that of the *puathi* but the internodal length and the length of the petiole are considerably less than in *Puathi*.

Cultivation

The cultivation of *pan* is attended with many difficulties; it requires an evenness of temperature, shade, security from high winds and animals, a uniform degree of humidity and much attention on the part of the cultivator. The plant is propagated by cuttings or sets under shade within specially constructed sheds of thatching grass sides and roof, called *boroj*, so designed as to admit of a diffused light.

Preparation of the land: After selecting the land for the *boroj* it is thoroughly ploughed and cross-ploughed a number of times and then heavily manured with well-rotten cowdung which is incorporated thoroughly with the soil. The soil is then levelled with a ladder and a trench dug all around the *boroj* to help drainage.

Construction of the boroj: After the preparation of the soil a *boroj* is constructed over the land. The *boroj* is a shed with a roof and walls. It is generally made with bamboo posts, beams and rafters, and thatched with *ulu* (*Imperata arundinacea*) grass, both on the sides and roof, tied with grass ropes and split bamboos. The height of the *boroj* varies from 6 to $6\frac{1}{2}$ ft. There are no fixed dimensions as regards the length and breadth which vary according to the means and choice of the grower.

After the construction of the *boroj* the plot is divided into ridges and furrows. The length of the ridges and their distance apart varies with the individual *pan* grower; usually they are $4\frac{1}{2}$ to 6 ft. in length and $1\frac{1}{2}$ ft. apart. The furrows in between the ridges help easy drainage after showers.

After making the ridges and before planting the *pan* sets, bamboo strips of the height of the *boroj* are stuck on the top of the ridges in pairs, one against the other, 7 to 10 pairs in each ridge.

Pan sets and planting: The old plants in the *boroj* provide sets for planting. The old vines are cut into small pieces, each containing at least six nodes. Leaves are stripped off from the three lower nodes and three leaves are kept in the upper three nodes. The top part of the vine,

which is very tender, is discarded. These sets are planted at the base of each alternate bamboo strip on the ridges. The set up to the level of the lowest leaf is placed below the soil and the soil thoroughly packed up, the three leaves remaining above the ground.

Time of Planting : Time of planting varies in different localities and with the individual grower. Usually planting is done in the months of *Jaistha-Asar* (June-July) and *Aswin-Kartik* (September-October). But *Jaistha-Asar* is considered to be the best time for planting as during this time the sets give out roots easily and the largest number of cuttings are found to survive.

Irrigation and manuring

Just after planting, watering becomes necessary. Plants are thereafter irrigated frequently so that the soil always remains moist. Care is taken against flooding which is injurious. The plants generally take root in three or four weeks' time after which frequent watering is not necessary. In certain parts of south Sylhet it is a common practice to irrigate *pan* sets after planting with a liquid manure made of cowdung and water which is said to accelerate rooting. After plants have taken root irrigation is done whenever necessary. During the monsoon usually no irrigation is required.

When the plants have given out roots and are well established they are manured. Mustard cake is considered to be the most suitable manure for this crop. The new plants during the first year are manured with a mixture of powdered mustard cake and wood ash, while the older plants from the second year onwards are manured with powdered mustard cake only. Mustard cake is ground very fine and applied in small quantities around the roots of the plants after which it is covered with very fine earth scraped from the furrows in between the ridges. Manuring is done usually from *Jaistha* (May-June) to *Kartik* (October) and then stopped completely. Five to six manurings are done during this period and 15 to 45 md. of oilcake per acre applied, depending upon the age and vigour of the plants.

Earthing : Sometime after manuring earth is brought from river beds wherever *borojes* are situated near rivers or streams or from other place, crushed very fine and sprinkled along the ridges and also on the furrows to be piled along the ridges in future. River silt is very highly prized for this purpose and used wherever possible.

When the *pan* vines reach the roof of the *boroj* the *pan* leaves on the vines are stripped off with the exception of the young ones at the top. The entire vine is then trailed on the ground along the ridge, the bud end bent upwards and tied to the bamboo strip support. This lowering is done as many times as the vines reach the roof. This operation is generally done after earthing so that after lowering of the creeper, the extra portion of the stem remains on the ground uncovered till the next earthing.

Removal of stem : When these lowered creepers take root from the nodes in contact with the ground the extra useless stem lying on the ground is carefully removed in June-July.

Harvesting

When planting is done in June-July plucking commences in October ; when planting is done in September-October plucking begins in May-June. Leaves are plucked from the lower parts of the plants and only the mature leaves are gathered from each plant at intervals of 8 to 10 days ; usually two to four leaves are obtained from a plant at each plucking ; during the rains four to six leaves are harvested. For five to seven years the plants are in full bearing after which the yield gradually falls off. After plucking, the leaves are brought home. The female members then wash, sort out and count the leaves and make them ready for the market.

A *boroj* usually bears for 10 to 15 years but *borojes* bearing for the last 30 to 50 years have also been observed.

Cost of Production

The cost of production has been found to vary from locality to locality. An average estimate is given below :

1st year (*cost per acre*)

	Rs.	a.	p.
Preparation of the land, ploughing, harrowing, laddering, etc.	36	0	0
Cowdung 600 md.	21	0	0
Bamboo strips for support	45	0	0
Bamboo for posts	45	0	0
Bomboo for roof and fencing	105	0	0
Ulu grass for thatching	75	0	0
Cane for tying	9	0	0
Pan sets for planting	75	0	0
Oilcake 15 md.	30	0	0
Labour for construction of the *boroj* ..	45	0	0
Labour for planting the set	22	8	0
Six permanent labourers for one year at Rs. 12 per mensem	864	0	0
Rent for land	7	8	0
Total ..	1,380	0	0

2nd year

	Rs.	a.	p.
Bamboo for repairs	105	0	0
Cane for tying	6	0	0
Oilcake	90	0	0
Ulu grass	24	0	0
Six permanent labourers	864	0	0
Rent for the land	7	8	0
Total ..	1,096	8	0

From the third year the expenses of repair increase gradually till it becomes necessary to overhaul the *boroj* thoroughly every sixth year. The total expenditure in five years comes to about Rs. 6,000 or Rs. 1,200 per acre per year.

Yield of leaves and profit: Yield of leaves has been found to vary considerably. Mukherji[1] holds that when no damage is done to the crop by fungus pests, on an average 80 lacs of leaves are obtained from one acre of land annually.

No crop will be reaped in the first year. Allowing for damage due to diseases, insect pests and accidents if the average yield be taken to be 60,00,000 leaves a year and if the price be taken to be Re. 1 for 2,000 leaves then the gross income is Rs. 3,000 a year from one acre of land. From the four crops during the five years, thus, Rs. 12,000 will be obtained; deducting Rs. 6,000 as the expenditure to be borne during the five years the income comes to Rs. 6,000 or Rs. 1,200 a year.

[1] Mukherji N. G., *Handbook of Indian Agriculture*, 1915, p. 313.

MOISTURE AND AIR IN FILLING SILOS

IN experiments conducted in the past 20 years by the Field Husbandry Division, Dominion Experimental Farms Service, it has been found that the moisture content of the crop is the most important factor. The most suitable moisture content is around 65 per cent, but it is possible to make reasonably good silage with the moisture ranging from 5 per cent above or below that amount. Next in importance and closely connected with the moisture content is the control of the air in the silage mass. It is undesirable to force all of the air from the interspaces of the cut crop, only a small amount of air being necessary for the functioning of the ensilage process.

To provide the proper amount of air in the silage the following precautions should be observed : (1) The walls and the doors of the silo should be airtight. See that there are no small holes or cracks ; (2) The moisture content of the crop should be about 65 per cent; (3) The silage cutter should be set to cut in $\frac{1}{4}$ lengths; (4) The silo should be filled as quickly as possible. Holdups over 24 hours should be avoided ; (5) The heaviest and wettest material should be placed on top to provide pressure on the entire mass ; (6) A limited amount of drainage should be located at the bottom of the silo to prevent waterlogging or accumulation of moisture ; (7) Pack solidly, taking care to fill in and tramp well any pockets that may occur near the walls. Even after the silage is settled, it is well to examine the top from time to time to see if any shrinkage from the walls has occurred.—*Department of Agriculture, Canada.*

AN YEAR IN AN APIARY IN THE CIRCARS, MADRAS

By A. Sankaram, B.Sc.(Ag.)

Assistant to the Government Agricultural Chemist, Madras, Coimbatore

To the amateur beekeeper it is very important to have general information on the breeding, swarming and developmental phases of bees during the different months of the year so as to enable him to regulate the several operations he has to perform from time to time, for the best upkeep and successful management of the apiary. With the aid of observations made in the plains of the West Godavari district, a guide has been prepared giving the several operations essential at various stages during an year. This guide has been prepared only from observations made in the plains of this district, but it may in general, be applicable to most parts of the Madras province. There may however be slight variations in certain localities depending upon the local pasturage and weather conditions.

Status of local bee pasturage

The West Godavari district, as a whole, excepting some portions of Narasapur and Bhimavaram talukas, offers scope for successful apiculture. The garden land crops such as *Sesamum* (*gingelly*), *Sorghum* (*cholam*), and *Coriandrum* (coriander) coupled with fruit crops like mango and citrus, form the main source of bee pasturage in the district. Besides these some of the wild flora comprising of weeds and scrub jungle in the reserve forest areas of the Tadepalligudem taluka, constitute a subsidiary but a potent source of the two bee foods.

With the cessation of the north-east monsoon season, the honey flow season in the tract commences by the end of December and extends up to the end of April. During this period the bee activity is in full swing and fair quantities of honey are obtained. Coriander, mango, citrus, plantain and *gingelly* remain in flower at different periods in the season, and assure a continuous and abundant supply of nectar and pollen throughout. With the break of the south-west monsoon in May the slack season in honey flow commences and continues for a period of six to eight weeks. Later the activity of the bees is accelerated with the second crop of *gingelly* and the flowering of tamarind (*Tamarindus indica*) and once again fair amounts of honey are obtained till the end of July. The north-east monsoon period of September to November is a lean season for all hive activity, owing to lack of adequate pasturage. The main honey flow season starts once again towards the end of December with the cessation of the north-east monsoon.

A list of the important bee pasturage crops with their approximate periods of flowering as observed by the writer in the district, is furnished below :

Common name	Botanical name	Flowering period	Yield	Remarks
Gingelly	*Sesamum indicum*	July	Nectar	1st crop
		February-March	do	2nd crop
Coriander	*Coriandrum sativum*	January-February	Nectar	Good source
Cholam	*Sorghum*	December	Pollen	Good sour ce of pollen
Maize	*Zea mays*	August	Pollen	
Tamarind	*Tamarindus indica*	June-July	Nectar	
Neem	*Azadarichta indica*	March-April	Nectar	
Citrus	All Sp of Citrus	January-July	Nectar and Pollen	1st flowering
			do	2nd flowering
Mango	*Mangifera indica*	February	Nectar	Good source
Plantain	*Musa paradisiaca*	—	Nectar and Pollen	Throughout the year

Calendar of operations

January : The month is characterized by very brisk brood rearing resulting in the marked increase of the population of workers and drones. Citrus, mango and coriander in flower supply nectar and pollen in abundance. Hive activity now naturally centres round honey accumulation and vigorous comb construction. The initial signs of swarming appear in the excessive rearing of drones and formation of a number of queen cells along the lower edge of the brood combs. In anticipation of the latter an intelligent apiarist will do

well, at this stage, to place old pots on the branches of shady trees around the apiary for attracting swarms.

February : During this month brood rearing is in full swing resulting in an enormous increase in hive population. This finally leads to congestion, overcrowding of the bees and absence of sufficient room for the queen to lay eggs. Besides comb building, indications of persistent swarming are also seen. Swarm control is the most essential part of apiary management during this month. Swarming of bees is a natural process of distribution and perpetuation of their kind. This is a very strong impulse on the part of the bees but should be prevented by all possible means, in the interests of honey production, the main object of the industry. This can be accomplished by :

(i) removal of queen cells that contain eggs or grubs by careful examination at frequent intervals.

(ii) destruction of the reigning queen and all queen cells except one fully developed and sealed ; and

(iii) prevention of overcrowding and congestion in the hive at the same time providing ample empty space for the queen to lay eggs.

Prevention of overcrowding should be brought about during this month when brood development is at its peak. For this purpose one or two well-sealed brood combs without bees can be removed and supplied to weak colonies in the apiary, and empty combs or artificial comb foundations may be kept in their place. By frequent honey extraction supers can be cleared for the bees to accumulate honey. In spite of all the timely manipulations certain bees are however, such determined swarmers that they are not satisfied without swarming. In such cases artificial division should be resorted to. Thus the numerical strength of the apiary can be increased and it is not uncommon to find both the parent hive and the artificially divided colony to yield fair quantities of honey under conditions of good pasturage and favourable season. As this month happens to be the season for the birth of new queens, it is not uncommon to find some of them being lost during their mating flight rendering their respective colonies queenless. Immediate steps are necessary to requeen such colonies. The month represents the peak of honey flow.

March : Even though the general brood rearing level is well maintained in the month, a considerable fall in drone population is apparent. Swarming impulse continues to be present though not to the same degree as in the previous month. Comb construction is very dull in all-parent hives, but in the newly settled swarms it is very rapid. Bee colonies continue to yield appreciable amounts of honey from the available pasturage. Certain natural swarms that might have settled in the old pots during February, would have well settled by now with varying number of brood combs. These can be transferred with advantage into standard boxes. A number of such transferred swarms have been noticed to be very vigorous and quick in their development and most satisfactory in their honey yield. The month under review may be marked as one for good honey flow.

April : A distinct setback in brood rearing and marked absence of comb construction are the striking features in many of the hives during the month. A slight decrease in honey yield is a common feature.

May : The month is very dull with regard to honey flow. Other activities such as comb construction and brood rearing are very poor and even absent in many cases. The nectar yielding pasturage becomes considerably poor but a limited supply of pollen continues.

June : Honey accumulation commences once again though not to an appreciable degree. Brood rearing is absent and comb construction is seen to a certain degree.

July : Honey yield is continued till the end of this month. An appreciable reduction in the drone brood is a prominent feature of all the hives and forcible ejection of the drones by the workers is not uncommon. The second crop of Sesamum (*gingelly*) in flower, forms at this juncture, an important source of nectar.

August : A complete slack season in respect of honey flow and other activities of bees begins from this month. Artificial feeding was found necessary for the weak colonies in the apiary, to prevent their desertion. Bee pasturage tends to become poor from this month onwards.

September : Features of the slack season continue during the month. An essential part of apiary management during the month consists in successfully controlling the damage done by the wax-moth (*Galleria mellonella*). All possible steps should be taken to keep the colonies strong so as to enable them to withstand the damage from the pest. Superfluous combs have to be removed and they may conveniently be stored in an airtight receptacle.

Frequent examination of the combs to remove the affected ones, if any, is an important step in the control of the pest. Such affected combs can be preserved for later use after exposing them to sun to clear off the wax-moth caterpillars. Very badly affected combs should be destroyed. During each examination of the hives in the apiary the base board and all other parts should be cleaned thoroughly with a view to pick out and destroy the eggs of the wax-moth. As the female moth has a tendency to lay eggs in small cracks and crevices in any part of the hive, such spots should be filled in by a suitable paint. In certain bad and neglected cases the change of the entire body of the hive becomes inevitable. So, great care has to be taken to check the pest as otherwise the entire apiary may dwindle to nothing at times.

October: The damage by the wax-moth becomes serious and all the measures enumerated during the previous month to check the pest hold good during this month also. As cyclonic weather of the north-east monsoon with strong winds generally prevails during this month, the boxes must be secured well to the stands to prevent their falling to the ground.

November: Indications of the commencement of general brood rearing and comb construction are noticed towards the end of the month. The pasturage is fair and honey accumulation also begins.

December: Active brood rearing and quick comb building are pushed on during this month, which reach their peak towards its end. Honey accumulation continues with some rapidity. At this stage one or two supers can be added and comb construction in the super frames can be stimulated by giving small pieces of clear combs. This will provide ample space for honey accumulation in the coming season. Artificial comb foundation sheets can be used during the month and in the following brisk months too, when scarcity for natural combs is felt.

Only intermittent care needed

A perusal of the calendar of operations presented above will reveal that the nature of the beekeeping industry is such that it keeps the beekeeper engaged for only short periods in the year and that even the attention that is necessary during such short periods is so limited in extent and intermittent in character that it will not disturb him at all in the pursuit of his main occupation. Further this limited and intermittent attention falls far short of the minimum attention and labour necessary for any cottage industry to be run with success.

Economically sound

As a hobby for recreation combined with profits beekeeping industry should prove very popular with our farmers. The economics of a few of the well maintained rural apiaries of the district that were under close supervision of the writer, are tabulated below. The profits seem to be distinctly encouraging for the capital invested and labour devoted.

Profit in Beekeeping

Apiary No.	No. of hives	Capital invested Rs.	Honey yield 1940 lb.	Gross income[1] Rs.	Net profit[2] Rs.
1	10	40	110	96	82
2	6	25	50	44	35
3	8	30	80	70	60
4	4	16	70	62	56
5	6	25	75	66	57
6	5	20	55	48	42
7	4	16	40	35	30
8	6	25	50	44	35

[1] Honey is valued at 14 As. per lb. (Local price).

[2] The net profit is arrived at by deducting 1/3 of the initial capital investment from the gross income, assuming that the equipment lasts for a period of three years.

KANS GRASS AND ITS ERADICATION

By Malik Fazl Hosain, Dip. Agri. (Wye)
Estate Manager, Imperial Veterinary Research Institute, Izatnagar

It is now recognized that by far the most important factor responsible for the poor outturn of agricultural production in this country is the exhaustion of the essential plant foods from the soil by repeated and intensive cropping. There are, however, other potent factors which have also been affecting crop production significantly. One of these is the infestation of certain arable areas by the weed known as *kans*. This is a deep-rooted, perennial plant which grows in all kinds of soils but, naturally, prefers good soils where it spreads rapidly into a thick bushy growth (fig. 1).

Kans multiplies chiefly through underground suckers (creeping stems technically known as rhizomes), which are formed in abundance during the monsoon. During the hot, dry season when conditions are unfavourable for growth, *kans* does not however die out but thrives by storing up its food material in its underground creeping stems and by sending roots deep into the sub-soil for water. When a cultivated land is infested with *kans*, the plant foods required for the crops are extensively appropriated by it. Consequently, the crop plants deprived of adequate nutrients starve and the final yield is poor. In many heavily infested areas the cultivators find it difficult to get rid of these weeds with the implements they have. Very often they lose all hope and sometimes even abandon the land.

Methods for eradication

So far, the problem of eradicating *kans* has not received any organized attention from the agricultural authorities of this country. Perhaps the absence of departmental initiative in this direction has been due to the lack of a suitable method for eradicating the weed. In recent years, however, two methods, viz. (i) the Indore method and (ii) the Central Provinces method, have gained a certain degree of publicity.

The Indore method

While offering his views on the Indore method, Dr J. K. Dubey of Bhopal, in his note to the Imperial Council of Agricultural Research, remarks that the use of Howard's *kans* eradicator which only partly helps in controlling the weed is not a solution to the problem, and is quite expensive for an ordinary cultivator. The picking up of the *kans* further adds to the expenditure. Trying to pick it up in early monsoons when *kharif* operations are in progress is beyond the means of cultivators. Any rhizomes which are left in the soil strike root with great vigour in this season. The present writer shares the views of Dr Dubey on some of the important operational aspects of the Indore method. No method can claim to be successful unless it can ensure the complete smothering of the *kans* rhizomes.

The Central Provinces method

The Central Provinces method of eradicating *kans* by the cultivated fallow system has proved, in our hands, of little practical value. The failure of the method under Izatnagar conditions may be ascribed to the following reasons: (1) In the Central Province methods ordinary *desi* plough has been advocated for cultivating the infested area. While such an implement is considered the only contrivance available to an average Indian farmer, it is, however, our constant experience that the country plough can make but a very mild impression in a *kans* infested area. Not only the country plough fails to produce any tangible effect on the *kans* roots thrown deeper in the soil, but directly, it also helps towards a heavier infestation by scattering the cut rhizomes, which strike root during the cooler months following the monsoon. (2) At no stage in the Central Provinces method of eradication, removal and the destruction of *kans* roots exposed on the surface by ploughing and cross ploughing have been suggested. It has been observed that *kans* roots are tough, the roots appearing superficially dry soon shoot up as they come in contact with moisture. It is therefore realized that apart from up-rooting the *kans* by cultivation, it is absolutely necessary to collect the roots and subsequently either destroy them by burning or convert them into compost. (3) The initiation of the eradication operation with the arrival of the monsoon has proved,

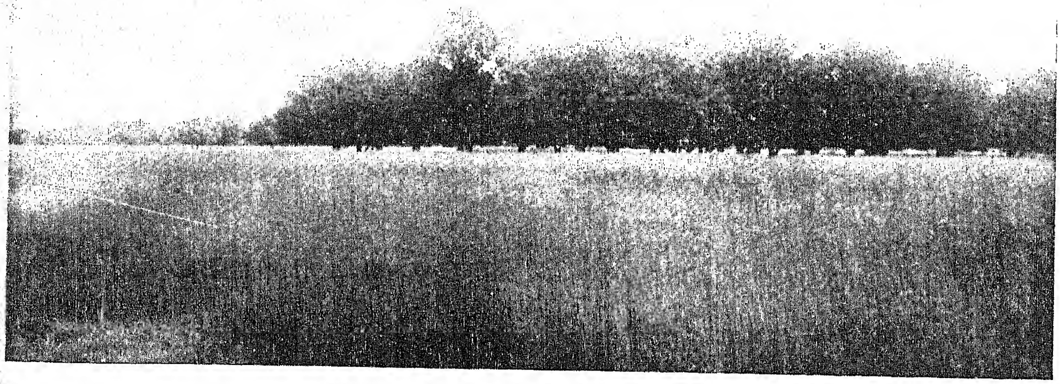


FIG. 1. An abandoned area heavily infested with Kans

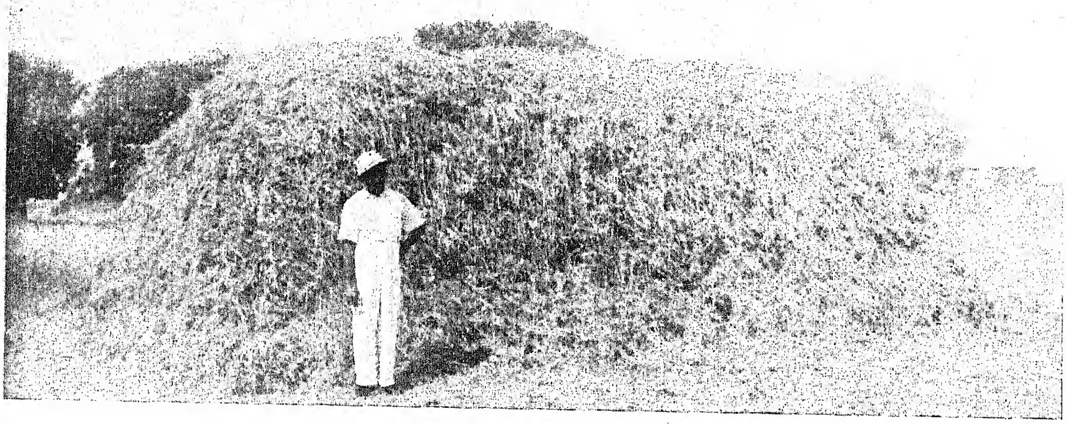


FIG. 2. A heap of collected Kans roots from an infested area

FIG. 3. An area showing a good wheat crop after reclamation from Kans infestation

PLATE 14

under Izatnagar conditions, to be rather ill-timed. *Kans* roots, exposed on the surface by the cultural operation, have to wait for a considerable time before they are acted upon by the desiccating effect of the summer sun. In the intervening moist and cool periods the exposed fragments again strike root and become alive.

In the supplementary leaflet published by the Department of Agriculture, Central Provinces and Berar, the eradication problem of several weeds including *kans* has been generally discussed and the following additional information has been supplied in regard to the eradication of *kans*: 'The fields and its boundaries should be ploughed to a depth of 9 to 10 in. early in summer. A second ploughing should be given in the rainy season about 6 in. deep and the stubbles removed completely. For complete eradication, ploughing will be necessary again in the next year. Bunding and collecting rain water to smother the weed is also an effective remedy.'

The Izatnagar method

At the Izatnagar Farm of the Imperial Veterinary Research Institute systematic work has been carried out for the last two and a half years to eradicate *kans* from the infested areas of the Estate, and the methods evolved have proved very successful.

Soon after harvesting the *rabi* crop the infested area is lightly irrigated in order to soften the soil. It is then divided into small plots of one acre and each such small plot is cultivated by a 'Victory' plough yoked with two pairs of bullocks. As the plough moves forward, 10 to 15 men are engaged along the furrow to pick, pull and, if necessary, dig up the exposed *kans* roots which are immediately collected and disposed of. Before the plough returns to the starting point of its next concentric course, the collection and disposal of the *kans* roots from the first furrow must be complete, as otherwise the exposed roots are liable to be covered up by the soil of the second furrow. After the ploughing and the collection of roots are done, the plot is cultivated again with a 'cultivator' yoked with one pair of bullocks. In the second light cultivation small fragments of roots which are brought to the surface are rigorously collected by handpicking. The whole operation takes about 12 hours and by the end of this period almost all the *kans* roots have been removed (fig. 2). However, in order not to allow any small fragments of isolated rhizomes to take root again, soon after the start of the monsoon, sunn-hemp seeds are sown in the plot under treatment. When the sunn-hemp crop reaches a height of about 3 ft. it is buried and allowed to decompose.

It is claimed that by adopting the method described above complete eradication of *kans* can be effected in one season and the field thus treated get ready to hold the next *rabi* crop (fig. 3). In case sufficient labour cannot be mustered for collecting *kans* roots, an alternative procedure has also been evolved.

In this method, after cultivation with the 'Victory' plough and partial collection of the roots, the 'Cultivator' is used several times (3 to 4 times according to the extent of infestation) in order to bring the roots to the surface. They are left in between cultivations to be acted upon by the sun and hot and dry winds during the long summer months. Most of the exposed roots are thus destroyed. With the advent of monsoon, sunn-hemp is sown as in the first method. This method, however, does not achieve complete eradication in one season, but a second season's treatment should give the required results.

Ensuring total eradication

A few additional measures were adopted at Izatnagar to ensure permanent success and these are as follows : (1) In a *kans* infested area, the ridges demarcating the neighbouring fields have often been found infested. In order that these ridges might not turn into seed beds for a subsequent infestation, they were treated like the fields themselves, and new ridges made after the area was shown to be completely cleared of *kans*. (2) In the irrigated areas infested with *kans*, the sides of the irrigation channels are frequently covered with *kans* growth, and these cannot be treated by the above methods. In this case, the roots were first dug out and collected as completely as possible from the channel sides, and *dhoob* planted in them extensively. The quickly spreading *dhoob* effectively subdues the propagation of *kans*. (3) In order to soften the soil (preparatory to applying the Izatnagar method of eradication) in the non-irrigated areas, it is necessary to take advantage of the winter rain in December-January, and to alter somewhat the time-table of operations. Owing to the heavy infestations of *kans* a large portion of the non-irrigated area at Izatnagar had to be left uncultivated for a number of years. When this area was taken in hand for restoration,

the thick surface growth had first to be mowed down before cultivation, and the alternative Izatnagar method of eradication was found more practicable, although, comparatively slow in yielding successful results.

Three distinct operations are involved in the successful eradication of *kans*. These operations in order of precedence are, (a) the exposure of the underground creeping stems of *kans* roots by deep cultivation with a heavy plough, (b) the collection by hand picking and the rigorous disposal of the exposed roots, or alternatively when the hand picking cannot be very thorough, the bringing of them to the surface by frequent light cultivation, to ensure their complete destruction by the influence of sun and heat, (c) finally the smothering of any residual *kans* rhizomes by a heavy growth of sunn-hemp.

State aid necessary

In the course of intensive work on this problem for the past two and a half years, the writer has come to the conclusion that the operations described above are essential if the eradication of this obnoxious weed is to be successfully and permanently accomplished. It is, however, recognized that they are expensive and beyond the means of the peasant farmer. State aid is, therefore, necessary if the vast areas at present heavily infested with *kans* are to be restored to usefulness.

WEEDS COST FARMERS MILLIONS OF DOLLARS

BY reducing the volume of crops and depreciating the fertility of the land, weeds cost the farmers of Canada millions of dollars every year. In time of peace, weed control is one of the most important phases of agriculture. In time of war when more and more food must be produced, weed control is vital. In this work the National Weed Committee is carrying out an energetic campaign, its Secretary, W. H. Wright, Plant Products Division, Dominion Department of Agriculture, being in direct communication with all agricultural authorities and farmers throughout the Dominion. All methods of weed extermination and control are under review.

In the chemical control of weeds, a recent test at one of the Dominion Experimental Farms serves as an object lesson. A plot of fibre plant badly infested with wild radish (similar to wild mustard) was treated on half of its area with cyanamid dust. In the treated part, the weed received such a setback that the crop at once took the lead and for the remainder of the season smothered any of the dwarfed weeds that might have regained vigour. On the untreated part, the wild radish flourished from the beginning and was rapidly maturing seed by the second week of August, while the crop was only half the height of the fibre in the treated part. In this instance, the fertilizing value of the cyanamid to the crop and its herbicidal action on the weed added to make the contrast more striking, but the same result in varying degrees must follow elimination of competition by weeds however secured, for example by other herbicide preparations, such as iron sulphate or copper sulphate for spraying. These remedies can be used safely in cereal or grass crops, but not in clover. Obviously, they are unnecessary in crops that can be cleaned by intertillage or by late spring cultivation before sowing.

According to the research work carried out by Professor T. K. Pavlychenko, University of Saskatchewan, perennial weeds are eradicated by chemical herbicides, not by the direct destruction of the roots but by indirectly producing a durable sterility of the top soil which prevents growth above ground until the underground parts not in direct contact with the chemical perish of suffocation and starvation.—*Department of Agriculture, Canada.*

MANURING OF COTTON IN INDIA

By V. G. Panse

Institute of Plant Industry, Indore, Central India

THE general level of yields of agricultural crops in India is low and cotton is not an exception. While accurate figures are not available the average yield of lint is most probably not greater than about 200 lb. per acre for irrigated cotton and about 75 lb. for rainfed cotton. These estimates compare poorly with the reported yield of 450 lb. per acre in Egypt and 350 lb. in Sudan, in both these countries cotton is grown under irrigation, while the average production per acre in the United States of America where cotton is not irrigated is as high as that of irrigated cotton in India. Cotton is grown over a large part of India and as a cash crop plays an important role in the economy of the Indian farmer. The need for increasing its yield is, therefore, obvious. This increase is likely to be brought about more easily by manuring than by attempting to breed higher yielding varieties. In the first place, improvement of quality is rightly considered to be the primary objective of the cotton breeder in India today and if a simultaneous increase in yield is also sought, it will render his task more difficult. Secondly, only a small increase in yield may be reasonably expected through breeding, and though the grower will secure it without any cost to himself, this cannot provide the solution of the problem of poor yields.

Experimental evidence

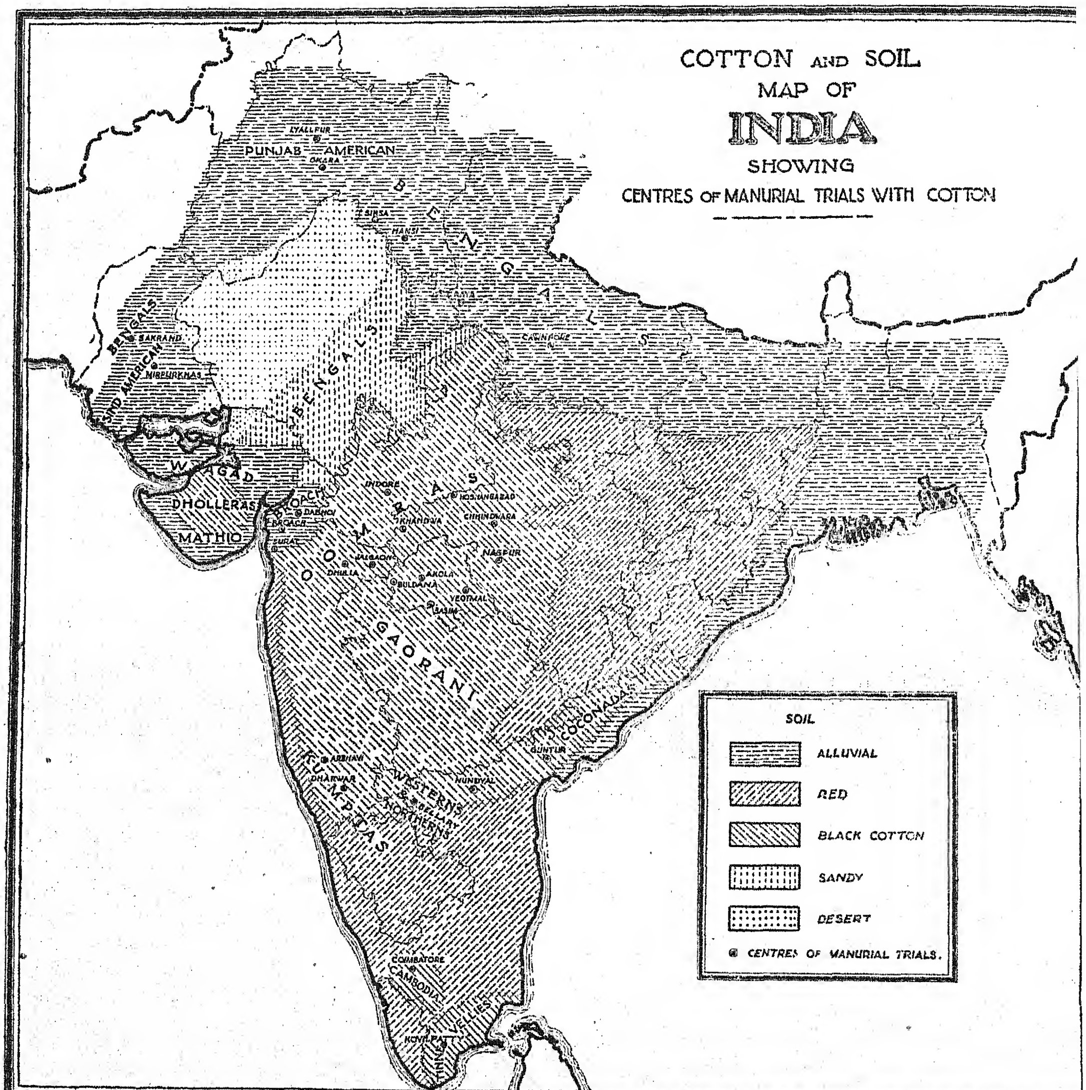
Sound recommendations for manuring can be made only on the basis of adequate experimental evidence. The collection and interpretation of the necessary evidence is not a simple matter either, owing to the wide range of conditions under which cotton is grown in India. As a first step in tackling the problem, the Indian Central Cotton Committee decided that all available results of cotton manurial trials carried out in different provinces in the past should be critically examined. The information thus made available, besides its possible use for immediate practical application, would serve as a guide in planning future trials. The results of this examination are briefly described in the present article. It is proposed to publish the full report separately.

India may be divided into two main cotton tracts, (1) the Indo-Gangetic alluvium and (2) peninsular India. In the first tract, both *desi* and American cottons are grown on irrigation with the exception of a small proportion of *desi* grown on rain in the United Provinces and the Punjab. Cotton is entirely dependent on rain in the second tract, except Cambodia which receives irrigation on red soil in Coimbatore and Salem districts in Madras. Black cotton soil is the principal soil type of the tract and *desi* the predominant variety of cotton grown. The map on page 132 shows the soil types and commercial varieties of cotton produced.

Results of over 400 trials were examined. Trials on rainfed cotton in peninsular India were the most numerous and consequently more information on the different aspects of manuring of cotton in rainfed areas could be extracted from the data than was possible for the irrigated tract. It is also in the former tract that yields are particularly low and the need for raising them by suitable manuring the most urgent. Before summarizing the results, it is necessary to point out that manurial trials were restricted in the past to research stations and government farms whose number is too small considering the vastness and different types of the area on which cotton is grown. Again, the fertility of land and other agricultural conditions at these farms are usually superior to those met with in the surrounding district. The representativeness of the trials and of the conclusions derived from them is limited by these factors. A verification of the results by extensive trials under cotton growers' conditions is certainly necessary.

Classification of manures

The manures tried may be divided into three classes : (1) Inorganic or artificial fertilizers such as ammonium sulphate, nitrate of soda or superphosphate (2) Organic manures like oil cakes or bone meal and (3) Bulky manures such as farmyard manure or compost. Nitrogen, phosphate and potash are the three chief plant food elements supplied through the manures



either singly or in combination to the plant. Of these manurial constituents only nitrogen was found essential for increasing the yield of cotton both under dry and irrigated conditions. Potash proved to be without any value in all areas. Phosphate also showed no beneficial effect on yield over any large tract and is clearly of no general importance. In certain trials, however, as for example at Dabhoi in Gujarat, on red soil of rather low fertility at Coimbatore and at Okara in the Punjab, increased yield has been obtained by the application of phosphate either alone or in combination with nitrogen. These results indicate that there are patches of soil where cotton responds to phosphate manuring and further trials should be directed towards marking out areas where the nitrogenous manuring of cotton might be profitably augmented by the addition of phosphate.

To the general increase in yield brought about by nitrogen the following two exceptions were observed :

(1) In the irrigated tract, presence of soil salinity prevents the crop from responding to the fertilizer. This explains the dissimilar nature of results obtained at Lyallpur, including an adverse effect on the crop in some cases. Professor Dastur's recent experiments in

connection with the failure of the cotton crop in the Punjab have clearly demonstrated the close relationship between the degree of soil salinity and the response of cotton to application of nitrogen. In these experiments, the average increase in yield from a given amount of nitrogenous fertilizer in light sandy soil, free from salinity, was over eight times the response observed on land with a highly saline subsoil.

(2) In rainfed areas, manuring is not effective where rainfall is low. Under the more extreme conditions it may even depress yield. This is illustrated by the results of manurial trials carried out at Dhulia in West Khandesh district in Bombay and at stations situated in a belt running from west to east, and embracing the southern end of Bombay and portions of Madras north of Mysore State. The rainfall in this tract is precarious and the annual average ranges between 20 to 25 in. With such low rainfall, manurial trials do not appear worthwhile. The problem here is one of making sufficient moisture available to the crop and not of manuring.

Comparison between manures

A comparison between artificial fertilizers and other nitrogenous manures available from local sources is of particular interest. Artificials were mostly used for supplying nitrogen to the crop in trials on irrigated cotton in the Punjab and Sind ; but *toria* cake which was tried in a few experiments in the Punjab gave promising results and requires further trial. For rainfed cotton grown in black soil groundnut cake appears to be an excellent source of nitrogen and there is evidence to show that its efficiency may be even higher than of ammonium sulphate. A probable explanation is that under the uncontrolled moisture conditions prevalent in rainfed areas a part of the nitrogen from ammonium sulphate is lost without being utilized by the cotton plant, whereas nitrogen from the cake becomes more gradually and steadily available. Since the cultivation of groundnut in the black soil tract is extensive and is on the increase, the problem of profitable utilization of the cake as a cotton manure deserves a close study. *Neem* cake was tried at Koilpatti in the extreme south of the peninsula which also gave very promising results. Castor cake is not on the whole as good as these cakes and appears more variable in its effect.

For equal amounts of nitrogen added, farmyard manure or compost generally gives a much smaller increase in yield than either artificials or cakes. The nitrogen content of farmyard manure is low, being only 0·5 per cent, compared to 8 per cent of groundnut cake and 20 per cent of ammonium sulphate, and its release in a form suitable for the use of crop is dependent on the stage of decomposition of the manure and the amount of moisture present in the soil. Under certain conditions, farmyard manure might even utilize the nitrogen and moisture in the soil for further decomposition, thereby depleting the supply of these elements available to the crop. With sufficient rainfall and with irrigation this manure is more consistently useful.

The view that artificials should preferably be applied in mixture with organic manures has received considerable emphasis in the past ; but the present results do not support it. There is no evidence to show that such mixtures confer any special benefit on crop yield, beyond that to be expected from the effect of the individual components. This is illustrated by trials in which mixtures of groundnut cake and ammonium sulphate were employed. On the other hand, there are some trials in which artificial fertilizers in combination with farmyard manure or after green manuring have proved less effective than when applied alone.

Conditions for manuring

The question of vital practical importance with regard to manuring is whether and under what conditions it will pay. Its consideration involves not only the increase in yield obtained but also the ruling prices of manure and of cotton. For evaluating profits, it is necessary to formulate the relationship between the amount of manure and the corresponding increase in yield, by trying a wide range of manurial doses under representative conditions. The present results are not adequate for this purpose either with regard to the amounts of manure used, which were generally low, or the representativeness of the trials. Recommendations on probable profits from manuring or on the optimum doses of manure cannot, therefore, be made at this stage and will be possible only when more comprehensive trials are carried out. An examination of the available results on the basis of prices prevailing in the pre-war period (1928-37), indicates, however, that for rainfed cotton groundnut cake is a profitable manure over a somewhat wider range of prices than ammonium sulphate. The most profitable dose of both manures appears to be in the neighbourhood of 40 lb. of nitrogen per acre,

that is 500 lb. of the cake or 200 lb. of ammonium sulphate. With regard to farmyard manure, the expected increase in yield from its application is too small to leave any profit after paying the cost of the manure. It may be concluded that buying farmyard manure for manuring cotton is not profitable, and the limited supplies of this manure that are available would on the whole be put to a better use by manuring cereals preceding cotton, particularly in areas with a moderate rainfall.

Manuring of irrigated cotton is naturally more profitable because of the larger increases in yield secured from each unit of nitrogen applied. The optimum doses of manure would also be larger and results from two or three experiments with ammonium sulphate recently carried out in the Punjab suggest that the most profitable dose may be as large as 80 to 100 lb. of nitrogen or 400 to 500 lb. of ammonium sulphate per acre. Under suitable conditions there is thus scope for manuring cotton on a really heavy scale. Manuring of cotton at this rate is not uncommon in Egypt.

The time factor

An important function of manurial trials is the study of optimum conditions for manuring. For example, manuring done at the right stage would result in a larger increase in yield than if it were done too early or too late. Results of past trials provide some definite information on the proper time for application of manure. For the irrigated American cotton in the Punjab and Sind applying manure during intensive flowering is shown to be optimum. This period corresponds with the latter part of August in the Punjab. For rainfed cotton on black soil manuring near about the sowing time appears to give the best results, except possibly in areas with a higher rainfall where it might be delayed without disadvantage upto some six weeks after sowing. Cotton in Gujarat, which is botanically different, produces a more prolific vegetative growth and matures later. Trials at Surat show that for this cotton addition of manure six weeks after sowing would result in a higher yield than an early application.

Among other factors that might influence the response of cotton to manuring, the fertility of land and the nature of the season, which is chiefly reflected in the seasonal rainfall in the rainfed tract, are likely to be more important. Fertility is difficult to define in terms of the physical, chemical or other properties of the soil, since too many known and unknown properties are probably involved ; but yield which represents the integrated result of all these may be taken as a single measure of fertility for our present purpose. Examined in relation to the fertility of land, results of manurial trials both on irrigated cotton in the Punjab and on rainfed cotton in black soil lead to an apparently unexpected conclusion. It is found that a greater increase in yield is obtained by manuring cotton on fertile land than on poor land. In other words, soil conditions which are favourable for a higher yield also appear to enhance the response of cotton to manuring.

The adverse effect of soil salinity on the manuring of irrigated cotton in the Punjab has been referred to earlier. The fertility of land will also be affected by this factor, and yield on land with a greater degree of salinity will be smaller than on land with less salinity. This relationship seems to provide a plausible explanation for the above conclusion in respect of irrigated cotton. Results of trials on black soil with both artificial and organic manures indicate that at least some of the poor land in this tract is primarily characterized not by a deficiency of essential plant nutrients, but by bad drainage and consequent water-logging which interferes with the growth of the cotton plant and its capacity to respond to manuring. This reasoning is supported by the fact that the decreased effect of manuring on poor land becomes particularly noticeable in a year of heavy rainfall. This point is illustrated below by results obtained at Indore in 1937 and 1938 from a total of 19 manurial trials :

INCREASE IN YIELD OF *KAPAS* IN LB. PER ACRE FROM 125 LB. OF AMMONIUM SULPHATE (25 LB. OF NITROGEN)

	1937	1938
Fertile fields	96	86
Poor fields	60	14
Rainfall (in.)	38·6	50·3

Improvement of drainage and prevention of water-logging are necessary before the full benefit of manuring poor land may be realized. The adverse effect of heavy rainfall, though in a less severe form, is probably of a general character, and we may anticipate that the average returns from manuring would be reduced in years of high rainfall. At the other extreme, the futility of manuring cotton under conditions of a precarious and low rainfall has been commented on previously.

Need for more trials

This is the brief outline of conclusions derived from an examination of the results of past trials. The need for conducting more trials before recommendations on the manuring of cotton can be made with confidence has been emphasized already. These trials must form part of a well defined programme and provide comparisons over a wide range of quantities of nitrogen supplied through different sources including locally produced oilcakes. For working out optimum doses of manure, a knowledge of the precise nature of the relationship between the amount of manure applied and the increased yield obtained is essential. Among factors that might raise the efficiency of manuring the method of applying the manure deserves attention in the rainfed tract where manure broadcast on the surface is liable to be washed away by heavy showers. The alternative of drilling it close to the seed furrow is likely to preserve it better and make it more easily accessible to the young seedling. A comparison between drilling and broadcasting the manure should therefore be included in the trials in this tract.

Suggestions

When a number of factors relating to a problem require trial, the old practice was to try one at a time. If for example different kinds of manures and different quantities of nitrogen were to be compared, different manures at a single dose fixed arbitrarily were included in one trial and different doses of nitrogen supplied through a single manure were tried in another trial. By doing so, information on the relative value of different manures at different levels of application was entirely missed. Modern experiments are, therefore, designed to compare simultaneously as many factors as possible. When several factors are involved, the experiments however become complicated and have of necessity to be confined to research stations and government farms ; but as soon as results suitable for practical application become available, the trials must be extended to private fields in order to verify the results under the cotton growers' conditions. A large number of such trials have to be carried out to obtain conclusions of a representative character. Utmost simplification in the design of the trial is necessary, so that an ordinary farmer can conduct it with only a little assistance and supervision. Trials of this nature form a vitally important part of any programme of agricultural improvement, and the farmers' cooperation is essential for their success.

FEVERS OF DOGS IN INDIA

During the last few years, fresh light has been thrown on the cause of the common fever of the dog in India. This disease which is as much a menace to kennels as to privately owned dogs is characterized by intermittent fever extending over a period of 3 to 6 weeks, with progressive anaemia and emaciation and inflammation of the alimentary and respiratory tracts. Jaundice is fairly frequent and the main post-mortem features are enlargement of the spleen and liver with small haemorrhages on the mucous surface of the intestines, whilst the blood is pale and watery and fails to clot properly. In some cases of the disease, parasites known as *Babesia canis* or *Babesia gibsoni* (or occasionally both) can be incriminated as the cause. In other cases, however, showing a similar train of symptoms, these parasites cannot be found on examination of the blood. It is well known that the appearance of the parasites in the red blood cells is periodic and unless the blood examination coincides with these periods the diagnosis of tick fever may be missed.

In 1938, in an article on canine fever, published in the *Indian Journal of Veterinary Science and Animal Husbandry*, certain microscopic bodies were depicted in the cells of the blood-forming tissues and the suggestion was made that these might be developmental forms of *B. gibsoni*. Leading English and French veterinary opinion then drew attention to the fact that the type of fever described in the article had much in common with the now well-known specific 'rickettsial' fever of the dog and that the microscopic bodies above-mentioned were parasites, called 'rickettsia'. An opportunity to investigate this suggestion from abroad occurred during the summer of 1941 when the hounds of a hunt club in India were exterminated by a febrile disease of the type described in the article. In one hound kept under observation for some weeks, *B. canis* was found once, on daily blood examination, during the course of a sharp relapse what were believed to be rickettsia were found in the cells of the blood-forming tissues on postmortem, and the original disease could be reproduced in young dogs sub-inoculated with material from the spleen of this case. An independent authority in India agreed with the finding of rickettsia-like bodies.

In some of these cases, either *B. canis* or *B. gibsoni* can be found during the active phases of the disease and it is believed, at present, that tick fever of the dog may be a complex infection in which *B. canis*, *B. gibsoni* and *Rickettsia canis* may participate. Further research can alone elucidate the problem ; it may well prove that a specific 'rickettsial' fever of the dog can exist apart from a complicating babesial infection, and it will eventually be necessary to isolate these three parasites and study their reactions in dogs known to be quite healthy, just as is done in bacteriological studies on disease. One fact of importance has emerged from this work. Whereas, formerly, treatment of canine fever with arsenicals was disappointing and recoveries exceptional, combined treatment of early cases with arsenicals (particularly 'tryparsamide' 0 and with sulfapyridine, usually results in recovery. Of 12 dogs so treated in the last two years, 9 recovered completely ; two relapsed and died, but both these were advanced cases. This new treatment concurs with the recent observation of workers in Africa that one of the sulfapyridine series of drugs is practically specific against canine rickettsial fever in that country.

A last point worthy of note is that it has been shown in certain parts of Africa that human endemic typhus is spread from cases of canine rickettsial fever by means of the common dog tick. Tich typhus is also known to exist in India, but nothing is yet known as to the role of the dog as a carrier of the infection. This problem is now being investigated in conjunction with medical specialists in the field.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. During the cold season our cattle fall victim to a disease which is locally known as *maukhur*. The animals go lame, refuse to eat, with subsequent loss of milk and flesh. The mouth is full of ulcers, and between the digits of the hoof wounds appear causing lameness.

What is the cause of this disease and what measures are to be adopted in order to stop its recurrence and spread ?

A. This disease, commonly called 'foot-and-mouth disease', is caused by virus—which means an organism that cannot be seen under a microscope. It is very highly infectious. In some parts of India it is common for it to appear at fairly regular intervals, every 3 or 4 years during the cold season. Seldom does it appear in the hot months, when it does it is of a mild nature.

Treatment : There is at present no therapeutic agent or vaccine available, but preventive and hygienic measures can be adopted in order to check the spread of the disease.

Immediately a case is seen, the animal should at once be removed from the main herd to a place away from the village. The yard or byre should be thoroughly disinfected, preferably with a solution of washing soda. The village cattle should not be allowed to mix with animals from other villages during outbreaks. The affected or suspected animals should have separate attendants who should have absolutely no contact with the healthy animals. The feet and mouth of the affected animals should be attended to. The feet should be washed in *nila thota* or copper sulphate solution, dried, and coal-tar applied between the digits. The mouth should be washed with a weak solution of common salt. All hard dry food should be completely withheld and green and sloppy diet substituted, such as green grass, bran mash, rice or flour gruel.

Carcases should not be skinned and must be either cremated or deeply buried, preferably the former. Animals which have passed through an attack should only be re-introduced to the main herd a month after all active symptoms of the disease have abated.

Q. I have noticed a very large number of cases amongst horses of warts round about their muzzle. The warts range in size from a pin head to a big pea. If surgically removed, they reappear in clusters on the same spot. I shall be thankful to you if you can let me know the cause and treatment.

A. Warts are commonly seen in stock of all sorts. Usually they appear in crops, i.e. clearing up and recurring. The cause is said to be a filterable virus. Badly-nourished animals are particularly susceptible. The treatment consists in improving the nutrition of the animals especially with reference to mineral supplement and in snipping off the warts with a sharp pair of scissors and applying the following powder to the excised area :

$$\left.\begin{array}{l}\text{Calcium carbonate}\\ \text{Magnesium ,,}\\ \text{Potassium ,,}\end{array}\right\}\text{ Equal parts}$$

DON'T

Let water run off the land—as dry soils won't grow crops. (*From Agriculture Experimentalist*)

What's doing in All-India

MADRAS

By C. Vijayaraghavan
Millet Specialist, Agricultural Research Institute, Coimbatore

THE campaign started in 1942 for increasing the production of foodgrains in the Madras province was continued during 1943, along the same lines, with very substantial results. The Department of Agriculture pushed on the attempt to increase the area under food crops and also the average production per acre. Propaganda was directed towards inducing the farmers to reduce the area under non-food crops like cotton and groundnut. The recent order of the Government prohibiting the cultivation of *kharif* cotton alone in the districts of Cuddapah, Kurnool, Anantapur and Bellary, was brought to the notice of farmers and they were advised to grow foodgrains like Italian millet as mixture with cotton. With the help and cooperation of the revenue department fresh assignments of land were made for growing foodgrains and pulses.

An increase of nearly two million acres, amounting to 18·3 per cent of the target area aimed at, was secured during the year under paddy alone. In the case of *jowar*, *bajra* and *ragi*, the increase was nearly 14 lakhs of acres or 13 per cent of the target area. The increase in area under *jowar* was particularly large in the Coimbatore district, chiefly on account of the steep rise in the price of this foodgrain. With minor millets like *setaria* and *samai* (*Panicum miliare*), that could be raised on relatively poorer lands, the increase amounted to nearly 54 per cent of the target area. Growing of vegetables was also encouraged by a province-wide publicity campaign of the Agricultural Department, backed by a liberal supply of seeds of various vegetable crops.

Vegetables for the Army

Special schemes were in operation to produce adequate quantities of vegetables for the troops, without drawing upon the production intended for the civil population. Particular attention was bestowed upon English vegetables. On the Nilgiris an area of about 250 acres was cultivated with these vegetables ; the cultivators under the scheme being helped with seed, fertilizers and money. Steps were taken to increase the area of market gardening on the Kodaikanals by helping the growers with seed and other facilities. Vizagapatam and Trichinopoly have been other centres, where large-scale production of vegetables was organized for the needs of the army. At the Hosur Cattle Farm in the Salem district an area yielding about 1,000 lb. of vegetables per day was under cultivation. A site has recently been chosen in the Chingleput district for the production of about 5½ tons of vegetables per day for the troops.

Help to cultivators

In common with many other commodities in these abnormal times, the cost of manures like groundnut cake, bone-meal and fish-meal have also gone up to very high levels. The Government, with a view to increase the average production of existing areas, have made large-scale purchases of groundnut cake, bone-meal and the seed of various green manure crops and sold them to ryots at reasonable prices for use in the cultivation of food crops. A quantity of 1,027 tons of manure and 64 tons of green manure seeds has been sold during the year in this manner.

A regular supply of seeds of improved strains of paddy, *jowar* etc., was also maintained during the current year. Wide publicity was given to the advantages of using hand-pounded rice in preference to mill-polished rice and the use of wooden rice hullers popularized by numerous demonstrations.

More concessions

Besides these, various other concessions are being offered to farmers by the Government with the object of increasing the area under food crops. In Tanjore and Trichinopoly, land unoccupied for more than 18 months, is now being offered free of assessment for growing food crops. Government have also permitted

the removal of green leaf and leaf mould from the forest areas at concessional rates. In the Periyar tract of the Madura district, water was allowed to be let into the main channels as early as 16 May, nearly 15 days ahead of the usual time to enable the ryots to take out a first crop of paddy sufficiently early so that a second crop may also be raised in the season.

District agricultural officers are empowered to grant loans up to Rs. 50 to each ryot for the purchase of seeds, manures and implements and during 1942-43 a total of about Rs. 4·5 lakhs was distributed in this manner. The grant of these loans being free of interest are being availed of by ryots on a larger scale. Figures available for the Kistna and Chittoor districts show that roughly Rs. 3·75 lakhs and Rs. 1·75 lakhs respectively have been distributed so far in these districts alone during the current year.

Land colonization scheme

The Government of Madras have also devised a scheme of cooperative land colonization societies. Such societies are now functioning in the districts of West Godavari, Kistna, Chingleput, Tanjore and Coimbatore. Large blocks of waste land suitable for the purpose are assigned to these societies by the Government and these in turn, parcel out land among its members in plots of two or three acres for cultivation. The value of the plots is paid by the members to the Government through the societies in easy instalments extending over 20 years. Government also advances to the societies money required for purchasing implements etc., by its members. A total area of nearly 8,000 acres has been thus assigned to these colonization societies in the province.

All-out drive for 'Grow More Food'

In furthering the grow more food campaign the Agricultural Department has been working in close cooperation with the Revenue, Cooperative, Health and other departments. With the Revenue Department it did intensive work in the assignment of waste lands for the cultivation of food crops, in granting loans on a large scale for the purchase of seed and manure, and in the conduct of ryots' meetings. The Cooperative Department helped in the running of seed multiplication schemes and in financing the departmental seed farm work as well as reclamation of lands. The Health Department assisted in the proper preservation of manure in villages. In this work the local self-government departments (District Boards, municipalities and *panchayats*) also cooperated.

The composting of habitation wastes on a large scale was made possible through the cooperation of the various District Boards, Municipalities and *Panchayats*. The Public Works Department made every effort to provide larger quantities of irrigation water for food crops and for growing green manure crops on tank and channel bunds while the Forest Department made available to the ryots considerable quantities of green leaves for use as manure.

BOMBAY VEGETABLE EXTENSION SCHEME

As reported in the last quarterly report, every effort was made to find out all possible additional areas within the zones established with a view to bring them under vegetable cultivation so that the demands of the military could be fully met. According to the expansion of the original scheme, three more zones were, therefore, opened one in Nasik district and two others at Belgaum and Mahabaleshwar. The incessant and continuous rains for about a fortnight in the months of September-October damaged the crops sown in their seedling stage and difficulty was experienced for a time to meet the full requirements. However, the areas were resown and the crops are coming up all right.

Special measures

(i) Seeds obtained from U. S. A. were distributed and the irrigation Department was approached to sanction water for the additional acreage. Cooperative Societies, specially started for this scheme work at Nasik, Devlali in Nasik district and Jeur in Ahmednagar district, are working fairly well.

(ii) The Bombay Civil Supply Vegetable Scheme was started in this quarter. Thirty-six grain shops in suitable localities in Bombay were selected by the Director of Civil Supplies, Bombay and supply of vegetables from Surat to these shops was started on the 26 September 1943; 36 more shops were added and the supplies of vegetables continue to be regular.

The civil population of Bombay have appreciated the scheme and the direct result of the scheme has been that the price level of vegetables in Bombay has come down to a certain extent. The grain shops, however, are not able to sell more vegetables as planned in the beginning and ways and means are being found out to improve the sales. The production of vegetables near Surat, has been increased by about 300 acres and seeds from U. S. A. are being supplied. Crude oil is given, as a special case, for irrigating these additional areas with the help of pumps. The Scheme is appreciated by the cultivators too as they have been saved from the clutches of *dalals* to a certain extent.

(iii) The total expenditure for staff, etc. from 1 September 1943 to 30 November 1943, came to Rs. 4,671-12-0. The Defence Department placed at the disposal of the Horticulturist to Bombay Government, Poona, the sum of Rs. 6,86,468 and vegetables worth about Rs. 5,13,000 have been supplied during this period. The additional amount received is paid on account of the old bills which were outstanding.

(iv) Additional area under vegetables in the *rabi* season, in the districts is as follows :

Poona district (Military scheme) ..	1,000 acres
Nasik	1,225 acres
Ahmednagar district	400 acres

There is no additional area registered in Belgaum district and Mahabaleshwar, but the produce of 100 acres and 50 acres respectively is promised for supply to the military under this scheme.

Civil scheme

Surat district 300 acres : The average daily supplies of vegetables and onions during the quarter were as follows :

Military	lb.	Civil	lb.
Nasik district and Bombay	44,000		
Poona district	40,000	Surat dist.	5,000
Ahmednagar district	10,500	for Bombay.	

It is regretted that the yield figures are not yet ready for submission ; best attention is being paid to compile them and take out averages from all the Zones.

BIHAR

By A. P. Cliff

Special Officer, Grow More Food, Bihar, Kanke, Ranchi

ALTHOUGH the Hathia rains were in some areas very light, and in a few areas there was no rain in October or November, the *rabi* crop seems on the whole to have been extended in area and to be quite promising. Useful rains in January and February over most of the province have made *rabi* prospects decidedly bright. Except in parts of North Bihar, a decidedly good paddy crop was harvested from an area larger than the normal, and during November there were ample supplies of paddy and rice coming to the markets. With the drop in control price from 1 January, however, the flow to the markets has almost ceased; and, although very ample supplies are available in the villages, the procurement position is again serious.

Sugarcane harvesting is well under way. The yield in the main producing area of North Bihar is lower than usual as the monsoon was below normal. Sugar recovery is however quite good. Deliveries of cane to mills were slow because cultivators did not appreciate Government's ruling that 2 as. of the price per md. of cane should be retained by the mills to be invested by Government, on behalf of the cultivators, in savings certificates. The position has now been more fully explained to cultivators generally, and although there is still a grumble that the total price fixed for cane (12 as. per md.) is low in relation to current price of foodgrains, deliveries to the mills seem to be fairly normal. It is widely stated, however, that the acreage under the new cane crop will be considerably below that of last year. The writer doubts whether the reduction in area will be as serious as is claimed.

Regarding cane varieties, red-rot seems now to have appeared on a considerable scale in Co. 331, in South Bihar. Variety trials on cultivators' fields have been started on a considerable scale in both North and South Bihar, and considerable success is claimed for this method of both testing and popularizing new varieties.

Production of vegetable seeds

At Sabour and at Pusa schemes for the production of vegetable seeds on a considerable scale have been put into operation. Unfortunately so far only the commoner types of vegetables have been made to produce seed under the conditions of Bihar ; but considerable quantities of pure seeds of good types of these vegetables, are now being produced by the Department and will be available for sale. As the supply of vegetable seeds in the province has recently been very restricted, and the quality of seeds available has been very uncertain, the value of this Departmental production will be very considerable.

A great drive is being made to hasten the execution of minor irrigation works sanctioned, so as to get them into working order before next monsoon. Additional engineering staff has been sanctioned for every district and sub-division, and this staff has recently been appointed. In addition, the work of executing these schemes has been entrusted to the Agricultural Department ; and for this, and other such grow more food works, district agricultural officers of gazetted rank have been recently appointed.

New irrigation schemes

The Emergency Lift Irrigation scheme is progressing quite rapidly. Twenty-one tubewell sites have already been selected and borings have begun on 6 or 8 of these. In atleast one case water bearing sand sufficiently thick to give the volume of water required has been reached. Further the layout of the electric transmission line has been prepared and considerable progress is reported in the assembling of the necessary material. Every effort is being made to get at least some of these tubewells pumping water in time for irrigating the *rabi* crop of 1944-45.

Sample survey of crops

A further most interesting and important development has now taken place in Bihar. Government has decided to undertake a random sample survey of the areas under food crops in the province at the different seasons. The work is being undertaken under the guidance and direction of Professor P. C. Mahalanobis, whose random sampling of the area under the jute crop was completed on a provincial scale in 1941. The Provincial Government has already recruited the field staff for the survey, and work is to begin on the present *rabi* crops in certain districts for which village maps are immediately available. The statistical computation staff is being assembled and will be controlled by Professor Mahalanobis. It is expected that by this survey of the crop areas during the next few seasons, estimates of areas of the main food crops of the Province correct to within 2 or 3 per cent will be obtained, and that the food supply position will thereupon rest on a much sounder position than at present. The writer believes that the method, which was developed during five years' work by the Indian Central Jute Committee in collaboration with the Government of Bengal and under the guidance and assistance of Professor Mahalanobis, could very profitably be applied over the whole of the permanently settled areas, where reliable estimates of food crop areas and yields are so urgently needed.

MYSORE

By M. Vasudevamurthy

Secretary, The Mysore Agricultural and Experimental Union, Bangalore

A REVIEW of departmental work indicates progress along several lines. The number of 'A' Farms for seed multiplication laid out in 1942-43, numbered 2,243 as against 1,194 in the previous year. This enhanced activity was backed up by 29 seed farms, 208 subvention farms and 4,460 demonstration plots. The following figures show the quantity of seed distributed in different years :

Seed	1936-37	1939-40	1942-43
Paddy ..	253 *Pallas**	2641 *Pallas*	14,100 *Pallas*
Ragi ..	168 „	377 „	900 „
Groundnut ..	95 „	353 „	736 „

* *Palla* = 100 Mysore measures (seer)

Iron implements

The difficulty that the cultivators had in procuring iron materials was recognized and 1,422 tons of these were distributed through

Agricultural Depots in 1942-43, at a cost of about 2,42,000 rupees, and further arrangements were made for the supply of another 1,600 tons of material. Besides ploughs and shares, standard tyres, beams and other iron accessories for carts and bullock shoes are on the list of articles that are being supplied. Recently Rs. 7 lakhs have been sanctioned for arranging these supplies. A large order for 2,500 iron ploughs has been placed.

The serum institute

The Mysore Serum Institute prepared more than 14 lakhs of doses of biologicals in 1942-43, as against a little over 12 lakhs in the previous year. Peptone required for biologicals was manufactured in the Institute itself from the waste product called fibrin. It is reported that a vaccine of reliable prophylactic value against fowl pox was prepared and commercialized and a vaccine against pigeon pox manufactured at the instance of the military authorities was found to be very serviceable. Anti-rabic vaccines and urine hormone prepared in the experimental section are in transition stage from the laboratory to the field.

Rinderpest broke out in a very acute form in the Chitaldrug and Shimoga districts, and generally all over the State. Cattle movements were restricted and other preventive measures adopted. Special staff have been deputed to zones of severe outbreaks and measures adopted to check the disease.

The rains that threatened the crops at the close of 1943, left the tanks and reservoirs filled up. A hopeful summer season was thus in view and accordingly plans were drawn up by the department for an area of about 60,000 acres of summer paddy and about 36,000 acres of summer or irrigated *ragi*. The programme includes the supply of more than 1,500 tons of groundnut cake, 500 tons of ammonium sulphate and 700 tons of bonemeal to reinforce the local supplies of manures. The summer cropping is specially useful as a short-range programme in food production. The area under irrigated *ragi* in the State is about 1,00,000 acres. If another lakh of acres come under paddy the two together will form about one-fifth of all the irrigated area in Mysore. Water facilities and suitable strains of crops combining, seasonal replenishment of foodstuffs seem to be quite possible.

Ragi cultivation

In pursuance of the plan for cultivation of irrigated *ragi* in summer a leaflet has been published by the Department and widely distributed among the ryots. *Challakere ragi* and *ragi* of K_1, R 0009, and R 0324 strains are advocated for large-scale adoption. The first-named variety has a green compact earhead and is harvested within three months after transplantation, nearly 4 months including nursery stage. K_1 is a popular departmental variety of the green compact earhead type, which matures in about 4 months (8 to 10 days later than *Challakere ragi*) and yields about 6 *pallas* to the acre on an average. R 0009 is a selection from K_1 and matures in about the same time as K_1 ; but it is a heavier yielder. R 0324 is a cox-comb selection. It has violet branching earheads. It also comes to harvest in about three months from transplantation, but is capable of higher yields. The summer cropping is in short an adjustment to have the crop in the nursery plot for about 3 to 4 weeks and 3 to $3\frac{1}{2}$ months in the field.

Irrigation experiment

An irrigation experiment reported from the Nagenahalli Station in respect of paddy is interesting. In a leaflet on paddy issued by the Department a few months ago the economic use of water was particularly stressed, putting it as a motto : 'Take no more water than you can manage with, for down the channel, there are other paddy farmers'. The result of the above experiment is as follows :

Treatment		*Yield per acre*
Continuous irrigation	..	2,697 lb.
One day off in the week	..	2,656 ,,
Two days off in the week	..	2,800 ,,
Three days off in the week	..	2,502 ,,

This is said to prove that the existing irrigation rule of five days on and two days off is correct.

Conferences

The Economic Conference is in session with a number of its Sectional Boards and is reviewing the progress pertaining to the several subjects on its programme. The *grama sudharakas*' (Hobli Workers' rally was held at Hassan this week as a refresher course to indicate to the workers the methods to be adopted for awakening the villagers towards improvement. Under the auspices of the Rural Development Scheme a fortnightly Kannada Bulletin has been started.

MILK RECORDING NEWS

RECORDS for lactations completed during December 1943 have been received from the Beri and Meham areas in the Punjab and the Chata area in the United Provinces. The average yield of Hariana cows in the Beri area was 3,205 lb., of Murrah buffaloes in the Meham area, 3,853 lb. and of local buffaloes in the Chata area, 3,728 lb. Records for individual breeds are given below :

Hariana

Beri area, Rohtak district, Punjab : Twelve cows completed their lactations in December 1943, averaging 3,205 lb. The maximum and minimum yields were 3,656 lb. and 2,367 lb. respectively. Selected records are as under :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Milk yield	Maximum daily recorded yield
KM. 303	Sheodatt S/o Nanda	4	14.1.43	321	3285	17
PL. 9	Sardara S/o Ramdial	4	1.2.43	306	3376	16
MR. 8	Lakhi S/o Amilall	5	7.2.43	298	3498	20
MR. 4	Makigar S/o Nanha	6	17.2.43	290	3656	22
KM. 336	Kanshi S/o Ramji Lall	5	4.3.43	289	3604	16
DR. 1	Pirthi S/o Moti	4	1.4.43	243	3240	20
KM. 335	Richhpal S/o Ramdial	4	29.3.43	263	3306	16
DR. 13	Tulsi S/o Thandi	4	29.3.43	287	3260	15

Murrah buffaloes

Meham area, Rohtak district, Punjab : Three buffaloes completed their lactations during December 1943. The records are given below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Milk yield	Maximum daily recorded yield
ND. 173	Maman S/o Shob Ram	3	1.11.42	388	5733	25
ND. 66	Parbho S/o Shoh Karam	3	27. 2.43	274	3053	23
ND. 92	Ram Singh S/o Harnam	3	21. 2.43	287	2774	23

Local cows and buffaloes

Chata area, Muttra district, United Provinces : No cows completed their lactation under record in the area under this scheme during December 1943. The records of two buffaloes who completed their lactation yielding 4,510 and 2,945 lb. are given below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield
199	Doongorsing	2	6. 9.43	451	4510	16·0
—	Ramsing	1	12.12.42	358	2945	11·5

DAIRY COW FEED

HEAVY milk-producing cows use up a lot of minerals, particularly calcium (lime) and phosphorus. Supplementary minerals are not usually necessary when the cows are on good well-fertilized pasture, but on winter rations they may benefit by being fed supplementary minerals. A simple method of supplying the necessary minerals is to add two pounds of bonemeal, or the same amount of suitable commercial mineral supplement to each 100 pounds of the meal mixture.—*Department of Agriculture, Canada.*

KITCHEN NOTES

SOUPS are always a popular item on the menu, especially in the cold winter months. They may be made economically from various ingredients with which vegetable water, left-over gravies, and cooked vegetables may be included. Soup should be of good flavour, free of fat, and not seasoned to excess. It is most appreciated when served very hot. Thick soup such as vegetable broth, mutton broth or artichoke soup could be served as a main course, with a meat or sweet course to complete the meal. When this is done, meat and vegetables or vegetables and milk should be included in the ingredients.

Fresh young vegetable peelings such as carrot, parsnip, turnip, potato, artichoke, etc., are excellent both for flavour and food value. It is advisable not to peel young root vegetables, which should be well washed and the whole vegetable used. The dark outside leaves of cabbage and silver beet, which contain large amounts of minerals should not be discarded. When thinly shredded they add richness to a green vegetable soup.

Dried peas, string beans, root vegetables, and pumpkin may be used in place of fresh vegetables. The dried vegetables should be soaked overnight. Smaller quantities of dried vegetables are required than fresh, as they recover their natural bulk when soaked.

When meat stocks are used the maximum nourishment and flavour are obtained when bones are chopped fairly small and the meat cut into squares. Rabbit bones make a good stock for soups, and fish bones and heads are excellent for making fish soups. To make stock place ingredients in cold salted water and bring to boil slowly. Allow to simmer for 1½ to 2 hours, then strain.

Milk soups and *purees* are excellent, especially for children as they contain milk in addition to the vegetables. Powdered full cream milk may be used in place of fresh. Whenever a thickening is required, oatmeal, either plain or flaked, should be used instead of flour, but in this case the soup will take a little longer to cook than if flour is used. The addition of a little sugar to all soups will bring out the flavour (quantity : level dessert-spoonful to 1 quart of soup). A little curry powder will help to improve the flavour of soup which tastes rather flat.

Parsley, which can be grown easily, is rich in vitamin C and iron. It should be chopped and added to meat soups as a garnish.

VEGETABLE SOUPS

Some recipes for various nutritious soups are given hereunder :

CARROT SOUP (Approx. 4 servings)

1 lb. carrots
½ lb. onions
1 oz. butter of good beef dripping
1 oz. flour or ½ oz. oatmeal
1 pint milk
1 pint boiling water, salt, sugar, cayenne

Method : Cut the carrots and onions into dice and fry in the butter for five minutes. Add the water, cook until the vegetables are tender. Rub through a sieve. Blend flour with a little of the milk, add the rest of the milk to the carrot and boil. When boiling, add flour and cook for 10 minutes. Season and serve with chopped parsley.

GREEN PEA SOUP (Approx. 6 servings)

1 lb. green peas
1 pint milk
2 tablespoons flour or oatmeal
1 small onion
1 tablespoon butter
1 dessertspoon sugar

Method: Wash the peas and cook with the onion until soft ; press through a colander and return to liquid. Make a white sauce of the butter, flour, and milk and add to mashed peas. Add salt and sugar and cook for five minutes. Sprinkle with chopped mint. A little cayenne or dash of nutmeg adds to the flavour.

LETTUCE SOUP (Approx. 6 servings)

2 lettuces
½ cucumber
2 sprigs tarragon
1 sprig parsley
½ oz. butter
½ cup of cream (or whole cream milk)
2 yolks of eggs
1 qt. stock or water

The outside leaves only of the lettuces may be used. Outside leaves of cabbage, silver beet, or spinach may be substituted for lettuce.

Method: Shred the lettuces, cucumber, and herbs, and cook for about 5 minutes in the butter, but do not let them brown. Put them into the hot stock and cook till tender. Skim and when cool stir in beaten egg yolks and cream or milk. Let the soup stand on side of stove till thoroughly hot. Do not allow to boil.

'QUICK' TOMATO SOUP

To 1 cup of tomato sauce add 1 cup of vegetable water, ¾ cup of milk, small lump of butter, little salt, and sprig of parsley. Bring almost to the boil and stir all the time. The mixture must not boil. Add chopped parsley as garnish.

VEGETABLE BROTH (6 servings)

1 cabbage
1 carrot (sliced)
2 stalks celery
¼ lb. dripping
2 onions
1 turnip
½ cup barley
½ cup butter beans
1 dessertspoon sugar
Water or stock to cover

Method: Melt fat in pan. Add shredded cabbage and cook gently, add other vegetables and flavourings and cook till all vegetables are tender. Serve very hot.

CREAM OF POTATO SOUP (4 servings)

3 medium-sized potatoes
1 small onion
1½ pints milk
1 small turnip
Salt, pepper, parsley
1 blade of mace

Method: Peel potatoes, onion and turnip. Slice and cook until soft with a little salt in sufficient water to cover. Press through colander. Add milk, reheat and add flavourings and chopped parsley.

CREAM OF ARTICHOKE SOUP (4 servings)

6 artichokes
2 small onions
1 tablespoon butter or dripping
1 pint stock
1 pint milk
Parsley

Method: Wash and peel artichokes. Put them into a basin of cold water mixed with the juice of a lemon to prevent them from discolouring. When all are prepared, peel and slice onions. Melt butter in a saucepan, add onion and drained artichokes. Cook for five or six minutes, turning constantly to prevent browning. Add stock and parsley. Cover and simmer until artichokes are tender. Rub through a hair sieve and place *puree* in saucepan. Heat and stir in milk. If artichokes are small, use less milk or thicken to taste with cornflour dissolved in a little cold milk. If liked very creamy, add a little cornflour dissolved in milk, no matter the quantity of artichokes. If adding cornflour, bring to boil before serving, otherwise only reheat.

LENTIL SOUP (4 servings)

2 cup lentils
2 small onions
1 tablespoon dripping
3 pints cold water
1 carrot
1 turnip
Chopped mint

Method: Soak lentils overnight. Chop onions finely and cook without browning in the melted dripping. Pour in lentils, cover with the water, add a pinch of salt and pepper. Simmer slowly for 2 hours, rub through sieve, return to saucepan, add the carrot and turnip, grated, boil half an hour or longer, and just before serving add chopped mint.

OATMEAL AND MUSHROOM SOUP (6 servings)

2 tablespoons butter or beef dripping
1 medium onion
½ cup plain oatmeal
1 pint milk
1 cup mushrooms
1 dessertspoon sugar
1 quart water
Salt

Method: Peel onion and chop finely. Cook in butter for 15 minutes. Add water and boil, then add oatmeal. Boil gently for 10 minutes. Rub through colander and add the milk. When thoroughly heated, add the chopped mushrooms and salt. The mushrooms are sometimes improved in flavour by boiling for a few minutes beforehand.

PUMPKIN SOUP

1 lb. pumpkin
Pieces of onion, turnip, carrot, celery
2 level tablespoons plain oatmeal
1 quart water
1 cup milk
Salt, sugar, cayenne, pepper.

Method: Prepare vegetables and cut up roughly. Put into saucepan with the stock or water. Bring to boil and simmer gently till tender (about 40 minutes). Rub through sieve, or coarse strainer. Return all to saucepan. Blend oatmeal with a little cold water, add to soup and stir till boiling. Cook six minutes longer. Add milk and reheat without boiling. Garnish with a few cooked peas, or a little raw grated carrot.

Any mixture of vegetables may be used in

this method, provided the proportions are adhered to.

MEAT SOUPS

MUTTON BROTH (6 servings)

3 lb. neck mutton
2 quarts water
1 carrot
½ turnip
1 stalk celery
1 onion
3 oz. barley
Salt, pepper
Chopped parsley

Oatmeal may be substituted for barley.

Method: Joint the mutton, but do not divide it. Put it into a saucepan with the barley (which should have been soaking in cold water for 2 or 3 hours), pour over the water, and simmer gently for 2½ hours, taking off the scum as it rises, then add the salt, cut the vegetables into neat strips, and simmer with the mutton for another hour. Take off the fat, add the parsley and serve. The mutton can be served with caper or parsley sauce as a luncheon dish.

MULLIGATAWNY SOUP (6 servings)

2 quarts stock or water
1 apple
1 onion
½ oz. plain oatmeal
1 oz. butter
1 dessertspoon sugar
Boiled rice for garnish

Rycena may be used as rice substitute.

Method: Slice apple and onion and fry them in the butter. Sprinkle over the curry powder and flour, and brown also; pour over the boiling stock, and stir till the mixture boils again. Simmer gently for 1½ hours, rub through a sieve, return to the saucepan and bring to boiling point. Squeeze in the juice of half a lemon. Serve with boiled rice.

RABBIT SOUP (6 servings)

1 large rabbit
1 lb. pickled pork or bacon (bacon or ham bone may be used)
4 onions
1 turnip
1 tablespoon oatmeal
5 pints water

Method: Put pork, two onions and turnip in two quarts of hot water, and simmer for 1 hour. Wash rabbit, and add to it one pint of cold water, and simmer for another hour. Then remove rabbit and pork, cut off as much meat as possible, and put bones back (the meat may be used for a stew). Fry remaining two onions (cut in slices) till they are brown and put in broth. Simmer 2 hours, occasionally skimming surface. Thicken with oatmeal mixed to a paste, add salt, if not salty, taste. Strain and serve hot.

If oatmeal is used in place of flour for thickening soup, add when the stock and vegetables come to the boil, as it takes longer to cook than flour.—*The Journal of the Department of Agriculture, Victoria*, August 1943.

RIBOFLAVIN CONCENTRATED

A discovery that should have the doubly desirable effect of reducing the cost of one of the most important vitamins and at the same time finding a use for what is now one of the most nearly useless of dairy by-products.

Dr A. Leviton of the Bureau of Dairy Industry, U. S. Department of Agriculture, has found that when whey is being condensed to the point where crystals of milk sugar begin to form, the vitamin riboflavin is strongly absorbed on them. A concentration of as much as 300 micrograms of riboflavin per gram of milk sugar has been prepared in the laboratory, the speaker stated.—*Canadian Dairy News Letter*.

POULTRY HOUSING

SOME of the more important considerations when constructing a permanent poultry house for the main flock are location, size and construction, says E. Van Nice, Dominion Experimental Station, Scott, Sask.

Well drained land is most desirable for the location for sanitary reasons and the house should be where shadows from other buildings or trees will not fall on the front of the house. It is well to have some protection from the winter winds by having trees or buildings at varying distances on the north and west. Attaching a poultry house to a building occupied by other livestock is not recommended. Although a well managed flock of poultry seldom has lice or mites, sometimes these are present and through a comparatively tight wall and cause much annoyance to the livestock.

A further consideration is to locate the house where suitable yards may be fenced if required. As to the size of the house provision should be made to allow at least four square feet of floor space per bird for the utility breeds and slightly less for leghorns. Nests, water bowls and

feeders may be easily elevated sufficiently so that no floor space is occupied by them and by use of dropping boards below the roosts the entire floor space is made available.

To meet prairie conditions, poultry house walls should be insulated. In addition to insulation three main principles are desirable in any permanent poultry house : (1) A concrete floor. (2) One-third glass and one-third cotton in the front of the house (south) with no other windows. (3) A slatted ceiling and peak roof with fresh straw provided in this attic each autumn.

The concrete floor has the advantage of being easily cleaned and disinfected, which is not true of a board or earth floor. Clay floors may be safely used if packed in when wet and replaced annually to a depth of several inches, but this entails considerable work each year and in many cases it might not be done regularly due to the pressure of other farm work.

The cotton on the front of the house should be common unbleached material and should be securely fastened to the frames easily removed during the summer to provide more ventilation and to lengthen the life of the cotton. At least half of these frames should be hinged at the top allowing them to be hooked to the ceiling on mild winter days to aid ventilation and admit direct sunlight. Wire netting is required on the outside of the windows summer and winter.

The straw loft above the slatted ceiling supplements the ventilation and absorbs excess moisture during winter.—*Department of Agriculture, Canada.*

DEVELOPING LAYING STOCK

THERE are two cardinal points to be remembered in developing good laying stock : to select the best pullets from high production ancestry and, to assist the development of their laying qualities by good care and management.

An outline of the practice followed at the Dominion Experimental Farm, Nappan, N.S., may be of interest to Maritime poultrymen. The housing consists of a permanent brooder pen size 16 ft. × 16 ft. divided into two sections, each provided with a brooder having a maximum capacity of three hundred day-old chicks. The brooder is started at a temperature of about 90 degrees F. around the outside edge of the brooder and gradually reduced as the chicks grow older. Careful attention is necessary during the brooder period to prevent excessive heat, overcrowding or a severe chilling of the chicks. Planer shavings or cut straw is used as litter and is changed about every ten days. One two-quart container and one two-foot reel hopper are provided for each fifty chicks, increasing the number of drinking dishes and feed hopper size as the chicks grow older.

The ration for the first two weeks consists of a commercial chick starter only ; at the end of this period grain is fed in the proportion of two parts mash to one part grain, by weight. The chicks are allowed to run on an outside wire platform as a preparation for range conditions. When placed on range at about six to eight weeks of age, each one hundred chicks are given access to one-quarter acre and provided with a range house size 9 ft. × 10 ft.

At the beginning of this period the proportion of grain to home-mixed mash is gradually increased to two parts by weight of grain to one of mash. Later the amount of grain is increased until grain only is fed, as the birds reach maturity.—*Department of Agriculture, Canada.*

New Books and Reviews

MARKET TOWN

By John R. Allan (Oxford University Press and National Federation of Young Farmers' Clubs, 1943, pp. 80, 2*s*.)

THIS is another book, No. 2, of a series entitled 'The Story of the Countryside'. In it is related what one might see at any weekly auction sale in an English town. Each chapter consists of two parts ; one a description of what might be seen by a visitor on the day of the sale in Hallow Market ; the other a series of questions which one might use while visiting such a sale if he is interested in getting acquainted with the types of product offered there, their origin in the farming area, the personalities of the seller, buyer or auctioneer, sale techniques, and reasons people might have for making such transactions as characterize this type of sale.

The book begins by describing the market square early in the morning before the sale, before any one has arrived with livestock or vegetables for sale or for the purpose of buying. It describes the arrival of the people with their animals and produce, the setting up of the stalls and the auction ring. It then goes into the history of the sale, which had its origin many decades earlier. It changed greatly through the years as the productivity and demands of the countryside and its people changed, but it remained without interruption a weekly affair in this community. The auctioneer arrives, sets up his stall and the sale begins. Some of those present are in need of some young heifers for their dairy herd, others may be offering fat sheep for sale.

One's attention is then directed to the better known people among those present. Character sketches of a number of them, such as an important farmer, the local butcher, the proprietor of the grain market and others, are given. Those who are present as salesmen representing firms selling seeds, fertilizers and farm machinery, in the hope that they may meet the farmers and persuade them to buy, are also described. In most cases a brief description is given of the firms they represent, as well as of the men themselves.

The writer mentions how people gather at the various shops and stalls, as the sale comes to a close, to make purchases of supplies needed in their home or on their farm, for their family or for their work. He mentions briefly the local farmers co-operative organizations and the services they render and then tells how every one gathers at the different restaurants for a meal and a visit with others.

The final chapter considers briefly the need for shops, banks, professional people, education and lines of communication to make progress and contact with outside markets or sources of manufactured articles as simple and as convenient as possible.—J.N.W.

BACTERIA IN EVERYDAY LIFE

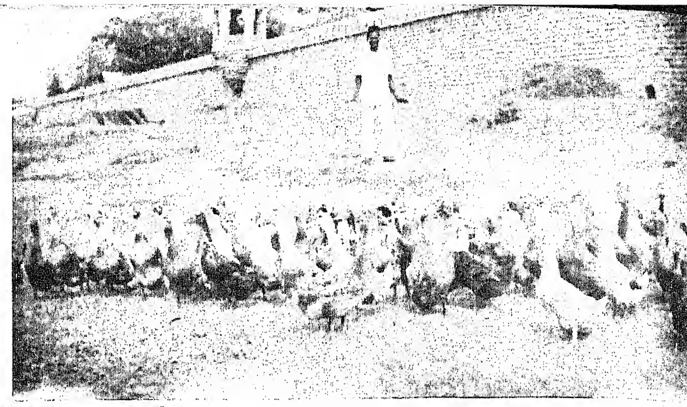
By Dr M. R. Madhok (Published by Dr M. R. Madhok, Punjab Agricutural College and Research Institute, Lyallpur, 1942: pp. 74, Rs. 1-8).

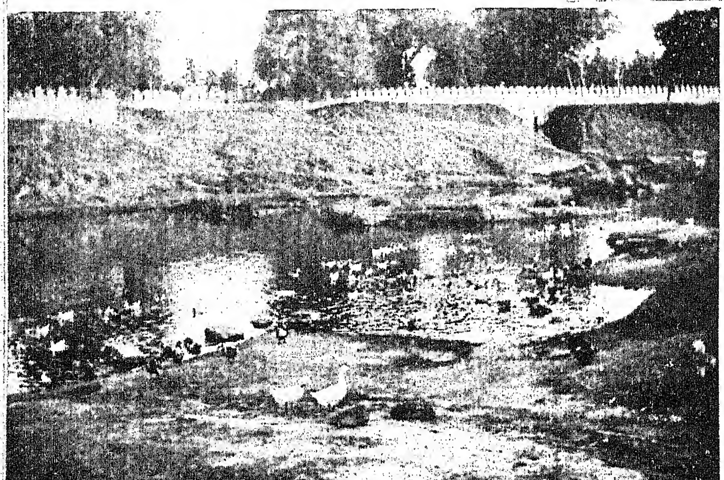
THIS is a handy booklet dealing with the different aspects of bacteria in everyday life. The contents include interesting chapters on the origin and scope of bacteriology, bacteria in agriculture, bacteria in arts and industries, important bacterial diseases, their causes and cure and so on. The book is written in a simple language and should prove to be useful to the students of agricultural colleges and others interested in the subject. The get-up is as good as can be expected.—S.C.R.

DON'T

Forget that the most important link in the chain of successful cropping is the seed you sow.

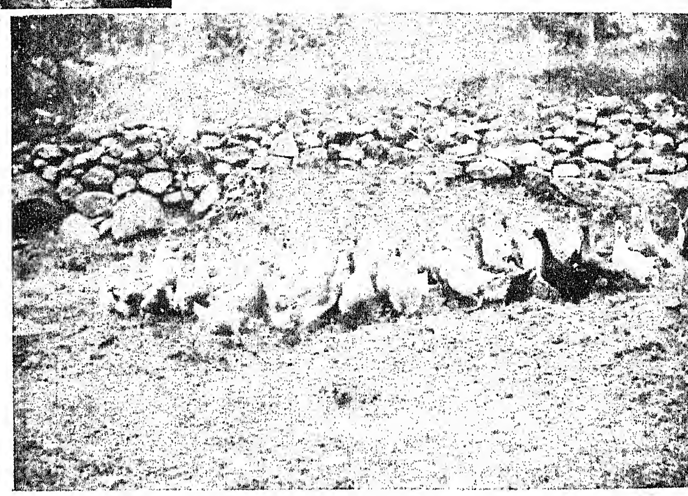
A flock of Madras type of ducks





A flock of indigenous type of ducks in the bed of river Moosi

2nd flock of indigenous type of ducks



A pair of Muscovy ducks

From All Quarters

FIGHTER ON THE FOOD FRONT

MR W. P. A. SOUNDARA PANDIA NADAR is a big landholder, residing in Pattiveeranpatti, an out-of-the-way village in Nilakottai taluka, Madura district. He owns plantations of cardamom, coffee and other crops in the hills. Apart from being a practical farmer, he is a very busy individual in public affairs having been elected recently as the President of the District Board. That he had successfully cultivated the seedless variety of grape vines on a field scale is a proof of his enterprising nature. Apart from all his activities, he takes particular pride in having contributed to the increase of food production in one of his blocks of land.

It is a block of 100 acres in a village named Endal and paddy is cultivated under a tank which receives its supply from the seasonal rains. Only one crop of paddy used to be raised in this area. But during the past year he proceeded with a determination to produce at least two crops. He did succeed. But he did not stop there. Due to a lucky shower in the summer, a small supply of water was received in the tank. The full area could not be commanded. Still he wanted to do something and he brought 36 acres under a short duration paddy. This plant grew well but it was feared that the water supply would run short and the crop may fail. He has a huge well to come to the rescue in all such contingencies. But due to war, he was not getting his liquid fuel. With special efforts, he managed to get the required fuel, worked the pump and succeeded in getting the crop through to maturity. What he was able to realize on these attempts are given below.

I Crop : 50 acres under the fine popular variety of rice of Madras GEB. 24 known locally as *doppi samba* and 50 acres under another local *samba* were raised. The yield was 2200 cwts. of paddy.

II Crop: He raised 50 acres under a short duration paddy and 50 acres under white sorghum and from this he got 1400 cwts. of grains.

III Crop : He could grow a crop only on 36 acres as detailed before and he got 576 cwts. of paddy.

In all he got 4176 cwts. of grains from 100 acres besides Rs. 4000 worth of straw to feed his cattle sumptuously. From one crop he got in the previous year 2240 cwts. of paddy only.

Apart from producing more food, the monetary gain is also attractive. During the previous year he spent Rs. 4000 and realized Rs. 20,160 worth of grains. In this year, he spent Rs. 8260 and obtained Rs. 37,584 worth of grains. The net yields for the two years are Rs. 16,160 and Rs. 29,324 respectively. Besides these, he was able to provide food to a larger number of labourers by growing more than one crop and they were all paid in kind for planting and harvesting.

He is rightly proud of these achievements.

DUCK BREEDING IN HYDERABAD

THE regions of high rainfall in India offer an ideal environment for duck raising. Of the total duck population of 166 lakhs in India, 149·8 lakhs are found in Bengal, Assam and the Madras presidency alone, and it is in these provinces that commercial duck raising is practised on a comparatively larger scale than anywhere else in India. In the Nizam's Dominions, where the estimated number of ducks is about 0·07 lakhs, duck rearing is popular only in Hyderabad city where the river Moosi and the drainage *nala* of Amberpett are extensively utilized for this purpose.

The availability of facilities for the sale of ducks and eggs and the natural resistance of ducks to contagious diseases are the chief reasons for the preference of duck raising to poultry keeping. Flocks consisting of 25 to 350 birds are maintained by individual owners who do not generally follow the rigid principles of selection and segregation in order to maintain the purity of the breed. The industry being in the hands of illiterate people, no attempt is made to improve the birds by scientific breeding, good feeding and management. Therefore, due to uncontrolled and promiscuous mating, the ducks raised are of mixed type.

The classification of these birds is generally made according to their colour, viz. *safaid* (white), *lal* (red), *ablak* (black and white), etc.

Jowar and paddy constitute the staple diet. The amount of these grains given per day varies from 2 to 2½ oz. The average yield of eggs per head per year of these mixed types ranges between 150 and 200, laid in four or five clutches. The market value of eggs, in normal times, is about Rs. 3 per 100, but during recent years the price has increased to Rs. 8 per 100.

Among these mixed varieties of ducks three distinct breeds are discernible. They are: (1) Hyderabad breed, with a small body and neck, slow in movement and poor layers, (2) Madras breed, larger in size, with a long neck and fairly active, and (3) Muscovy type, generally known as *mamola* ducks, rather rare, yielding from 120 to 180 eggs per year.—S. Nurul Mohlida G.M.V.C. Assistant Disease Investigation Officer (Poultry), Hyderabad.

SOYBEANS HAVE MANY IMPORTANT USES

THE soybean has filled certain definite requirements both in agriculture and industry for many years. Formerly a large portion of the soybean supply was obtained from Manchuria, the native home of the soybean, but wartime and transportation difficulties caused a serious depletion in the supply from that source. Fortunately, the foundation had been laid for growing soybeans in Canada and the United States, so it has only been necessary to extend the acreage devoted to the crop.

The chief value of soybeans is found in the protein and oil content of the mature seeds. Few crops grown in Canada may be considered as high protein producers, as soybeans and high protein concentrates are an important constituent of many live-stock feeds. The soybean is very valuable in this respect, supplementing the flax crop. Other uses have also been found for soybean protein in the fields of human nutrition, plastics, wood binding adhesives, water paints and many others.

Soybean oil, being of vegetable origin, also has particularly valuable properties, states C. W. Owen, Forage Crops Division, Dominion Experimental Farms Service. After various treatments, depending upon the ultimate use to be made of the oil, it may be used wholly or in partial replacement of other oils in vegetable shortenings and margarines, oil paints, soap, canning, linoleum, and many other products. In many instances soybean oil is being used to replace other oils which are now very difficult to obtain or are being used for essential war uses. As research progresses, more uses will undoubtedly be found for soybeans.—*Department of Agriculture, Canada.*

INDIAN FARMING

ISSUED BY

THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V APRIL 1944 No. 4

SKIM MILK

THE people of India, like those elsewhere, do not recognize the true value of skim or separated milk as a food. It is assumed that because the fat has been removed nothing of value is left. This assumption is wrong. The food value of whole milk is recognized by practically every one. What is not usually recognized, however, is that whatever qualities there are in whole milk as a food are also found in skim milk. The constituents of whole milk are also the constituents of skim milk, namely, butter fat, lactose, protein, ash and vitamins. The proportion of these constituents in the two products differs only very slightly in each case, except for fat and fat soluble vitamins. These are found only in small quantities in skim milk.

The heat energy value of skim milk is just under 45 per cent of that of whole milk, that is, 1 lb. of whole milk is equivalent to about 2⅓ lb. of skim milk for human food purposes.

Approximately 58 per cent of the milk produced in India, estimated at nearly 250 lack tons annually, is made into ghee, a by-product of which is butter milk or *chhachh*. *Chhachh* is never discarded ; it is known to be of considerable value as a food and is always useful for that purpose. The outturn of *chhachh* from whole milk from which ghee is made is probably about 75 per cent. Approximately 108 lack tons of *chhachh*, therefore, are made annually from that part of the annual production of milk in this country which is converted into ghee. This constitutes an extremely important part of the diet of our people. According to the figures given by both Dr. W. L. Davies and Dr. W. R. Aykroyd, the food energy value of *chhachh* is practically identical to that of skim milk, whereas it is commonly thought that skim milk has no value as a food.

Probably no one knows exactly how much skim milk is produced and is therefore available for use as a food, or for other purposes, in this country. In certain areas, particularly in Gujarat, United Provinces and Bihar, large quantities of skim or separated milk are available locally as a by-product for the production of cream for butter making.

Despite this very low opinion of the food value of skim milk, it is actually used in most parts of India for human food purposes. It is not purchased by the consumer as fresh skim milk or as skim milk *dahi*, but is consumed none the less. The fact is that skim milk is very commonly mixed with whole milk. This mixture is either then sold as fresh whole milk or converted into *dahi* and sold as whole milk *dahi*. Very little demand exists for fresh skim milk or for skim milk *dahi* as such, yet great quantities of these products are consumed in the manner indicated.

Attempts have been made by means of legislation to prevent the sale of skim milk by its mixture with whole milk. It is intended by such legislation that the deception involved in selling skim milk as whole milk might be controlled. It is questionable, however, whether by legislation requiring the colouring of skim milk such deception can be prevented. It is probable that, should the person who submits to this method of deceiving the consumer find it impossible, because of strict legal action, to use skim milk for this purpose, he would use water rather than refrain from the practice. Since skim milk has a considerable value as a food and since it is chemically and physically almost identical

to whole milk, it is just as safe, from the public health point of view, as is whole milk. It is better that it be used rather than water, therefore, if such practices are to be continued unchecked. Furthermore, those who will utilize skim milk as a food, if it is available in its normal condition, would refuse to use it if it were coloured. Such legislation, in the absence of adequate effective legislation otherwise, encourages the use of water in the first instance and discourages the use of skim milk as such for food purposes in the second instance. Other types of legislation would undoubtedly be more in the interests of our national welfare. Adulteration with water has not yet been effectively controlled.

The quantities of skim or separated milk that are available are usually greater than can be consumed locally. If this product is to be used wholly as a food some of it must be transported from the area in which it is produced to population centres where a market might be found for it for food purposes. There are certain characteristics of skim milk which make it impossible, under existing conditions in this country, to transport all of it from surplus areas to deficient areas, in order that it may be used for the specific purpose mentioned. These characteristics are its high perishability and its tremendous bulk. Skim milk will not keep longer than whole milk before deterioration, particularly acid fermentation, occurs. As acid develops the flavour becomes acidic and therefore undesirable, in the first instance; secondly, coagulation takes place. Just as whole milk which has an acid flavour or which is coagulated is usually seriously objected to or refused by the consumer, so also will skim in such conditions be refused. The time and temperature conditions, therefore, under which it is possible to transport any surplus of skim milk greatly limit the possibility of such transportation.

Skim milk contains about 90 per cent of water. It is consequently necessary to transport 90 lb. of water for every 100 lb. of this product. If transportation charges were based on the food value of a product, this difficulty in the full utilization of skim milk as a food would not exist. This, however, is not possible. Transportation costs must be paid on the water contained in the milk just as they must be paid on its solid material. Because of this high water content, the value of this product as a food is very quickly offset by the cost of transportation as the distance through which it must be transported increases. Skim milk may be processed by heating or the temperature under which it is handled and transported may be controlled by refrigeration to prolong its keeping quality. Efficient means of transportation may be employed. Taking these precautions would enable the transport of this milk over a greater distance to bring it into a market area, yet the limitations mentioned will still hold, particularly because they would increase the cost of making the skim milk available to the consumer.

It is inevitable, it would seem, that there will be quantities of skim milk available in certain areas which cannot possibly be utilized as such for food purposes. It will be necessary, therefore, to convert this excess skim into less bulky and less perishable products, or discard it. From the point of view of our national economy it is wise to convert this surplus into skim milk powder, condensed skim milk, casein or pork or poultry products, rather than destroy it.

In the manufacture of dried and condensed skim milk certain conditions must be met. Firstly, an adequate supply of raw skim milk must be available. How large such a supply need be will depend upon the size of the plant and other factors of cost. The quality of the raw material required for either of the two products must be exceedingly high, or an unsalable product will result. The minimum quantity of skim milk that must be available to make a condensory or a powder mill economic is estimated at somewhere between 20 and 50 thousand pounds daily. There are probably very few places in India where it would be profitable to undertake the manufacture of one of these concentrated products, principally because the quantity of raw milk required is much greater than what could be obtained. The perishability and bulkiness of skim milk, which limit its transportation for food purposes, will likewise limit its transportation for the making of either of these concentrated products. Those localities, therefore, in which the necessary quantity of raw milk *of the required quality*

might be available in this country are probably very very few, if such localities exist.

Skim milk might be converted into casein. The equipment necessary to make possible the manufacture of a marketable quality of casein is very simple, as compared to that needed for condensed or dried milk, and is comparatively very inexpensive. Furthermore, very much smaller quantities of raw skim milk are necessary for the manufacture of this product on an economic scale. It is possible to make a salable quality of casein from as little as 200 lb. of skim milk daily. The manufacture of casein, therefore, on purely economic and quantitative considerations, is much more feasible than the manufacture of concentrated skim milk. The quality of milk from which casein can be made does not have to be so high as is true of the dried or condensed product. One process by which casein may be made involves the natural souring of the milk. The formation of acid in milk intended for the manufacture of casein is for this reason a much less serious problem than in the skim to be used for the making of dried or condensed skim milk. Casein making offers considerable possibilities for utilizing skim milk under certain conditions.

Where there is a market for pigs and pork products, skim milk may be utilized quite effectively by feeding it to pigs. There are many people in the country, however, who do not make use of such products for food purposes. This limits the market for skim milk in this form. There are also many people who, for personal reasons, will not rear pigs so that the conversion of skim milk into pork and its products has its limitations. But in the absence of the objections or limitations indicated this method of utilizing skim milk should offer possibilities.

Skim milk is readily utilized by poultry, the marketable products of which are live birds, poultry meat and eggs. Wherever a demand for such products exist and whereever the objections to the raising and handling of poultry do not arise, this offers another possible use of skim milk.

From a national view point, particularly considering the nutritional and general health needs of our people, skim milk should be used as a food so far as possible. Every encouragement should be given to its use for this purpose. Legislation which prevents its use in this way, and which at the same time encourages the use of water should be opposed. Alternatively, such milk should be converted into pork or poultry and their products, which may in turn be used for food purposes. It would be advisable, where it is at all possible, to manufacture dried or condensed skim milk as it also could be used for human food purposes. Failing these possibilities, skim milk may be converted into casein, a product that cannot be consumed as a human food. There are conditions existing in India under which large quantities of skim milk can justly be made into such a non-food product. There is very considerable demand at the present time for casein and, except that it precludes the use of this valuable food product, skim milk, as a food, it should be made. Skim or separated milk should not be wasted.

Original Articles

PHOSPHATE MANURING OF LEGUMES

By C. H. Parr and R. D. Bose

Imperial Agricultural Research Institute, New Delhi

WILL it pay ? This pertinent enquiry is the first reaction to any recommendation in regard to manuring. Fertilizers cost money, they are always in short supply. In India, in normal times, their prices are usually above world parity, whilst those of the crops on which they are used are often below. Manures must be put to profitable use or left alone. When used at all, they are therefore, applied with care and to particular crops, cash crops as sugarcane, cotton, tobacco, known to give a return, quickly convertible into cash by which the cost can be met and a little is left over for other cash commitments. For an agricultural community largely under-financed, and more often than not operating under a load of debt no other attitude is practicable or possible. Immediate return is every thing. Still good cultivators do recognize that the maintenance of soil fertility, whatever its level, is an inescapable obligation and try to arrange for this by manuring to some extent, but more usually by cultivation and crop rotation in which nature gives a helping hand. The steady and persistent building up of increased soil fertility in the long view, however, is another matter, and offers rewards usually too remote and uncertain to any but those whose financial position puts them above the hand-to-mouth methods to which the average cultivator is driven owing to chronic shortage of ready cash.

It is to be hoped that the war prices now ruling will bring financial benefit to the cultivator. For the future good of the country, the opportunities offered by Governments for investing profits should be used to the full to build up a structure of financial stability, which will enable this hitherto somewhat impoverished peasantry to play their proper role as effective guardians of the country's main source of wealth—the soil.

Danger of short-sighted policies

A country whose agricultural policies are for ever decided by the limitations of immediate return must sooner or later suffer the consequences, whatever the necessities which dictate them. There is an inherent weakness in a system of land use which allows only those few possessed of some financial reserve to farm their land for the cumulative development of fertility. Whilst land use implies certain rights to immediate gain, it carries also obligations to posterity. A prosperous agriculture, a better standard of rural living, particularly in a country with a rapidly increasing population, is attainable only if both eyes are kept fixed on land development and a steadily rising plane of soil fertility to ensure an expanding output. Does it pay ? This question is permissible to those whose financial position allows of no alternative ; but to those whose finances are otherwise, the prospect of indirect and ultimate return should carry equal weight.

It is with this in mind that these remarks on phosphate manuring are presented. At this stage phosphate manuring on a large scale and as a general practice is not for the widows and orphans of agriculture but for the builders of the foundations of agricultural wealth, for the men with something to put into the land and on whom agricultural development largely depends it is an instrument with much constructive power behind it.

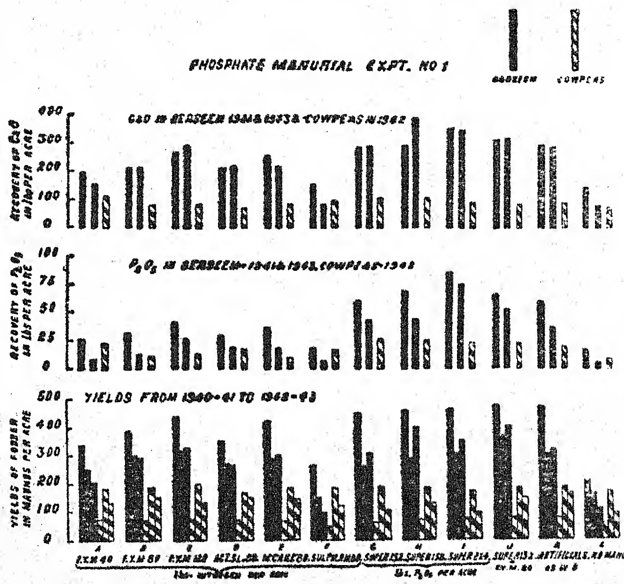
Phosphate-legume combination

Much has already been done to examine the use of phosphate in various parts of the country in many differing soils and in relation to a variety of crops. Bone-meal, alone and, in combination with other fertilizers and organic manures, has given increased yields of paddy in 56 trials in Madras and 41 trials in Bengal

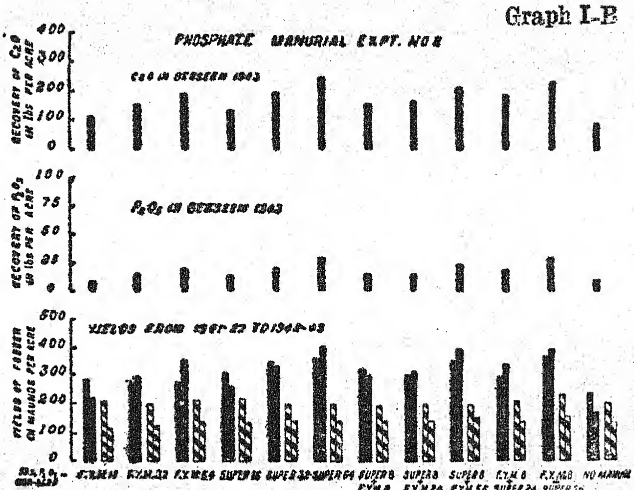
though in 25 per cent of the trials it was without effect. This suggests that phosphate in this form, which is deserving of more investigation, can play an important role in direct crop increase.

In this article, however, an account is given of attempts to use phosphate in relation to a special group of crops, namely, the legumes. India is favoured with an extensive flora of legumes—those well-known soil fertilizers which meet man halfway, and give back to the soil as much and sometimes more than they take out, and which through the ages have contributed so liberally to man's food supply, by virtue of their capacity to convert the free nitrogen of the air into edible protein in the form of foodgrains and fodder crops. As is well known, they do this with the aid of bacteria with which they operate in the same spirit of give and take and thus provide an inspiring picture of the latent cooperation in nature which awaits those whose approach is not that of the pirate, or of something for as little as possible. It is an old observation that nature responds generously to the wise the way this and a lesson is to be learnt from and generous, is portrayed by the legumes, so handsomely represented in India where their cooperation, already widely enlisted, is required still further.

Graph I-A



Graph I-B



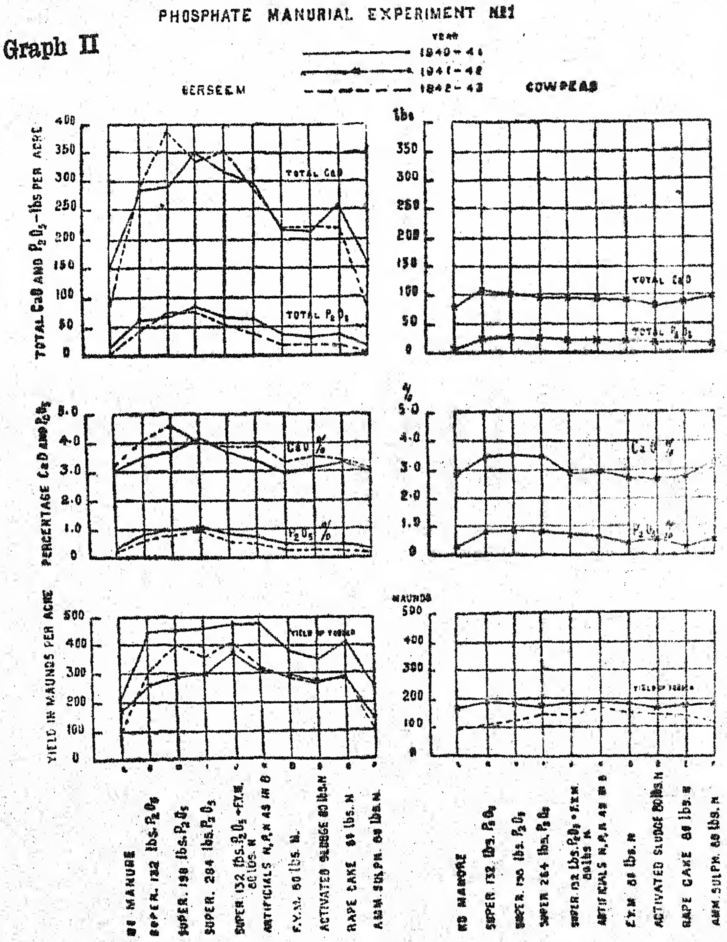
The legumes of agriculture need phosphate regardless of whether it is available in the soil or added as a fertilizer, and when it is provided, they respond in no half-hearted or niggardly fashion. Whether it is the legume or its associated bacteria which demand it matters little here, for in considering the one we must also consider the other. Taken as a whole the growth of legume crops in India is vigorous, perhaps even more vigorous than in European countries. But, in India, they have shown as much response to the applications of phosphate as can be claimed in Europe where, in recent years, much has been done to increase the yield of legumes, particularly, in fodders and pastures, by judicious and generous application of phosphate manures as superphosphate, basic slag, bonemeal, etc. Since the legume adds valuable nitrogen to the soil and since the amount of added nitrogen increases with increase in the legume yield, it would appear that phosphate manuring offers a method not only of increasing the yield of legume crops and thus protein production, but also, of supplying Indian soils with the much needed additions of

nitrogen for the benefit of crops such as barley, millets, etc., which need large wheat, quantities of available nitrogen for high yields.

Furthermore, both man and animals have need of, and are great consumers of phosphate. Phosphate, along with calcium, forms a very important constituent of milk and other nutrient foods. The total output of phosphate and calcium by high milking cows in this country is very considerable and constitutes a very severe drain on their bodies, from the reserves of which it is largely drawn. It is, therefore, of the highest importance that in the feeding of high milking herds, fodders rich in phosphates are supplied at all times to enable these animals to build up a big body reserve of phosphate with which the demands of high milk production can be met. Experiments referred to here have shown that phosphate manures not only increase the vegetative growth and the yields of fodder in legumes but also lead to very considerable increase in the phosphate content of the fodders themselves. So much so that a 100 per cent increase in crop yield has been accompanied by a 300 per cent increase in phosphate content, that is to say a total increase of 600 per cent in phosphate production per unit area.

PHOSPHATE MANURIAL EXPERIMENT No. 1

Graph II



Experimental results

Graph I-A and the statement which follows refer to yields of berseem in three successive years with crops of cowpea fodder intervening. They show the increase in yields of fodder and increase in phosphate content of the crops in phosphate manurial trials at Delhi. Superphosphate gave increases of fodder varying from 100 to 300 per cent over the no 'manure' plots and increases in the phosphate content of the order of 200 to 300 per cent. When the latter is considered as outturn of phosphate per acre it will be seen that in 1940-41 when the 'no manure' plot produced only 17 lb. phosphate per acre the superphosphate manured plots produced up to 80 lb. phosphate in the fodder per acre. In 1942-43, the third successive year of berseem under this experiment, in the same plot the outturn of phosphate was 6 lb. per acre in the 'no manure' plot and about 75 lb. in the phosphate treated plots, which suggests that some depletion of phosphate was taking place in the 'no manure' plot and that the liberal superphosphate dressing was barely sufficient to meet the full requirements of the berseem crop.

Graph II gives the yield of green fodder (berseem and cowpea), the percentage composition and the total phosphate and calcium in the fodder. It will be noted that in the year of highest yield (1940-41) the phosphate content was higher than in 1942-43, but this position was reversed in the case of calcium.

TABLE I

GREEN FODDER YIELDS, PHOSPHATE (P_2O_5) AND CALCIUM (CaO) CONTENT OF BERSEEM AND COWPEAS

Treatment per acre	Berseem (manured)							Cowpeas (residual)				
	Yields of green fodder in md. per acre			Phosphate (P_2O_5%) (top figures) & total in fodder in lb. per acre		Calcium (CaO%) (top figures) & total in fodder in lb. per acre		Yield of fodder in md. per acre			Phosphate (P_2O_5 %) & total in fodder in lb. per acre	Calcium (CaO %) & total in fodder in lb. per acre
	1940-41	1941-42	1942-43	1940-41	1942-43	1940-41	1942-43	1941	1941	1943	1942	1942
A. Farm yard manure — 40 N	334	248	208	0·40	0·18	2·98	3·17	74	182	131	0·75	3·77
				25·3	9·0	200	158				22·4	113
B. Farm yard manure — 80 N	385	297	289	0·48	0·26	2·95	3·33	69	184	154	0·42	2·65
				32·8	17·1	217	219				12·7	80
C. Farm yard manure — 120 N	434	319	324	0·53	0·33	3·21	3·78	67	197	134	0·40	2·51
				41·5	25·2	267	289				13·0	81
D. Activated sludge — 80 N	349	271	264	0·46	0·31	3·10	3·53	66	166	150	0·61	2·63
				29·8	19·4	212	221				16·7	72
E. Mustard cake — 80 N	415	291	297	0·50	0·29	3·38	3·42	63	181	146	0·33	2·80
				36·0	18·6	259	219				9·8	83
F. Sulphate of ammonia — 80 N	260	148	99	0·39	0·22	2·97	3·14	58	182	120	0·57	3·23
				19·4	5·8	157	83				17·1	97
G. Superphosphate — 132 P_2O_5	445	260	304	0·82	0·63	3·56	4·12	61	189	110	0·83	3·47
				60·9	44·2	285	289				25·8	108
H. Superphosphate — 198 P_2O_5	452	285	397	0·95	0·84	3·69	4·63	69	181	125	0·90	3·40
				69·5	70·6	290	389				26·8	104
I. Superphosphate — 264 P_2O_5	458	299	349	1·12	0·89	4·14	4·03	75	173	147	0·83	3·41
				85·9	74·7	352	338				23·6	97
J. Superphosphate — 132 P_2O_5 and Farm yard manure — 80 N	471	368	402	0·83	0·59	3·70	3·86	82	184	147	0·75	2·87
				65·6	54·1	314	354				22·7	87
K. Artificial fertilisers on the basis of treatment B	468	310	320	0·74	0·49	3·39	3·85	69	190	168	0·67	2·96
				60·1	37·3	298	293				21·0	93
L. No Manure ..	209	165	109	0·38	0·23	3·06	3·20	57	169	92	0·32	2·86
				16·7	6·4	146	89				8·9	79

(1Md. = 82·3 lb.)

It is to be noted that the berseem crop only was manured and that the cowpea crop was grown on the residue left by the berseem. It is noteworthy that whilst the yields of cowpea show little effect of phosphate manuring the composition of the crop was affected and the increase in phosphate content followed the same trends as were evident in the berseem. The absence of response in yield may be due to lack of capacity of the variety used to react in this way to higher doses of available phosphate and the selection of varieties for their capacity to react may be necessary to obtain types of the highest efficiency from the points of view under consideration. It may be that existing types of indigenous legumes have adjusted themselves to the level of phosphate of the soils of the areas in which they have, for centuries, been grown, and have lost any capacity they may have ever possessed to use more when available. Berseem is a crop imported from the phosphate rich soils of Egypt. The phosphate (P_2O_5) content of Egyptian soils is about 0·20 to 0·28 per cent. To make the most of our indigenous legumes it would appear that types capable of using more phosphate need to be bred in order that the fullest use of the possibilities of the phosphate—legume—nitrogen cycle may be made.

The calcium-phosphate composition of four cuttings taken in the normal course of the growth of the berseem crop showed a decrease in the phosphate (P_2O_5) but an increase in the calcium (CaO) content in the fourth or last cutting taken in April. As was expected the earlier cuttings showed a higher crude protein content than the later ones. These two factors may explain the decrease in palatability of berseem, as evidenced by the reluctance with which the milch cows of the Sahiwal herd take the later cuttings.

A comparison of the yield of fodder and the percentage of calcium (CaO) and phosphate (P_2O_5) shows that in the years of lower yield the phosphate (P_2O_5) content tended to decrease while calcium (CaO) increased, which suggests that a balanced intake of CaO depends on the availability of phosphate.

With smaller doses of phosphate either in the form of superphosphate or of farmyard manure, significant increases in the yield of green fodder and in the recoveries of phosphate and calcium, were also obtained (Plate I-B).

The chemical composition of the soil of a neighbouring field is shown below :

	Depth of soil.		
	0 to 3 in.	3 to 6 in.	6 to 12 in
Nitrogen (N)	0.059	0·053	0·041
Phosphoric Acid (P_2O_5) ..	0.107	0·101	0·094
Potash (K_2O)	0.388	0·397	0·380

The following figures give the phosphate (P_2O_5) content of some soils of the Punjab, United Provinces and Bihar. The wide variation from west to east is noteworthy and may suggest a reason why berseem is being grown so successfully in the Punjab, whereas comparatively little progress in popularizing the crop has been made in the canal areas of the United Provinces.

	Soils from				
Punjab	Multan	Lyallpur	Montgomery	Lahore	Karnal
Percentage P_2O_5	0·533	0·351	0·207	0·102	0·130
	Hissar	Rawalpindi	Ambala	Gurdaspur	
	0·188	0·198	0·139	0·100	

	Soils from	
United Provinces ..	Cawnpore	Partabgarh
Percentage P_2O_5	0·08	0·18

	Soils from		
Bihar ..	Pusa	Patna	Kanke
Percentage P_2O_5	0·10	0·13	0·077

Neglect to provide fodder and feed of sufficiently high phosphate content has in the past undoubtedly been the cause of much sickness and loss of milking animals in this country, even in well managed herds. There is evidence to suggest that deficiency in this respect is a contributory cause to such diseases as Johne's disease. Experience with the high producing animals of the Sahiwal herd of this Institute has shown the necessity for such provision and the possibility of loss, which failure to make this provision, may invoke.

Cows of pure Indian breed weighing about 1,000 lb. can now be bred to produce in 300 days out of every 400, a calf and about 10,000 lb. of milk containing 5 per cent fat, that is, about ten times their own weight of milk, containing dry matter equal to three times the dry matter content of their own bodies (450 lb.) and the same weight of calcium (CaO-14 lb.) and phosphate (P_2O_5 9 lb.) and other mineral salts as are contained in their bodies. This they may repeat eight times, or more, in their life time.

Limitations of stall feeding

The future of cattle-breeding development in this country must depend largely on the extent to which improvement in stall feeding of cattle can be effected. Stall feeding however tends to depend on the growing of certain specialised fodder crops which give high yields at a low cost and which fit in with the usual cropping rotations. The continued use of a few such fodders, unless supplemented by extensive and well managed grazing, throughout a large part of the year, provision for which is usually inadequate, will lead to the effect of any inherent nutrient deficiency or loss of balance that may occur in the fodders concerned being multiplied and exaggerated as time goes on. The cumulative effect of this will certainly show itself in some form or the other, particularly, as the productive efficiency of the cattle is improved. This may be counteracted to some extent by supplementing the ration with the particular nutrients which may be considered to be in short supply, but it is doubtful whether this will fully meet all the requirements. The value of added phosphate for manuring fodder crops may not be great when these are fed to unimproved cattle of low milk capacity. For animals producing on a high standard, it is a matter of supreme importance, often a matter of life and death, to supply, in the fodders themselves, the phosphate in the amount and in the particular assimilable form required by the animals. This may not be possible merely by adding the usual mineral supplements to the concentrate ration.

We are here concerned with an important cycle of operations which shows the close linkage effects in Nature of how phosphates applied to the soil can increase legume or protein yields per acre, and, even more strikingly, the phosphate content of the legume crop. Phosphate and its associate calcium are required in increasing quantities in feeds and fodders to maintain good health in animals, particularly under increased milk production and the increased legume growth induced by phosphate, leads to the building up of stores of nitrogen much needed in the soils for cereal crops.

Health through crop treatment

Health through food, and proper treatment of the soils on which the food and fodder crops are grown, is a question which is receiving increasing attention in all countries and concerns equally both the beast and the man. There is plenty of evidence of regional soil deficiencies in India which affects both the health of human and animal populations of the areas concerned. It is easy to be fatalistic, to blame the climate and succumb to helplessness. But are we sure that the effect of climate is direct ? The power of adjustment of the living organism is considerable. But the failure of the forces of evolution to eliminate the weak and the illadjusted suggests that there are other stronger forces operating at a greater speed. These causes may well lie in the changes taking place in the soil as a result of increased cultivation pressure under which the effects of climate, slight under semi-jungle conditions, have become dangerously exaggerated. We are all familiar with the effect of heavy rainfall in eroding rich surface soil. It should be the concern of all. There may be other processes going on in tracts of heavy rainfall which are not so obvious but which are the cause of loss of valuable mineral salts and other useful elements. This gradual loss coupled with intensive cropping, often single cropping, and heavy incidence of animal population, affect plant composition and are the cause of a lower standard of human and animal physique as compared with the areas of lower rainfall. This will be evident from a mere comparison of the health and physique of human population and that of cattle in the Punjab with those in Bengal. Other contributory factors there may be, as malaria in the human population and other parasitic diseases in animals, but their presence should not blind us to the possibility that soil deficiencies reflected in food deficiencies may be indirectly assisting in the havoc caused by these diseases.

The close relation between the composition of food and public health has been more fully recognised in recent years and has been further emphasised by experience under war conditions, particularly in Great Britain. Recognition of the close relation between food composition and soils and soil treatment grows more slowly. Of still slower growth, but of

no less importance from the economic as well as the health points of view, is the close relation that exists between soil condition, crop management and the animal breeding industries of any particular area. The greater prevalence of tuberculosis, abortion, Johne's disease, etc. on particular farms is not always due to less efficient management, but more often than not, to soil variation. Good stock farms earn their reputation more through the land than through any particular superiority of the skill of the farmers who have worked them, though naturally the good farmer will usually be drawn to the best land. It is known that many of these soil defects and differences can be remedied and much has been done by drainage and the use of lime, phosphate and other manuring methods, including even the addition of trace elements. Although, analyses of soils in India have given the impression that, in general, they are adequately supplied with phosphate to meet ordinary crop requirements, the amount of phosphate present may be inadequate for good health in animals bred for a standard of production which makes them economic, or for human beings working under the strain of Indian climatic conditions.

Balanced agriculture

Medicines, vaccines, sera, etc. for the treatment of specific diseases are undoubtedly essential, but the foundations of animal health are rooted deep in the soil and systems of balanced argiculture are required which provide for livestock their basic requirements in the best forms in which the soil can produce them. The development of Indian agriculture and the livestock industries to a high pitch of efficiency, which the future will demand, will slow down if the implications of this fundamental consideration are ignored.

The need for increased Nitrogen supplies for increasing crop production in India is well known and the possibilities of extracting nitrogen from the air by industrial processes will undoubtedly receive attention as soon as conditions permit. The possibilities of securing our nitrogen requirements by enlisting the help of nature, through the legumes, are no less deserving of attention. No large plant or capital investment is required. It is a process which every cultivator can employ to his advantage. To this end all sources of phosphate in the country should be explored. The selection and breeding of varieties of legume crops for their capacity to utilize phosphate and fix atmospheric nitrogen may be as important as their yielding capacity, though it is possible that the two characters are closely linked. They provide health giving foods and Nitrogen and soil fertility in Nature's own way. There is no question of the application of salts, the ultimate effect of which on the soil and the nutritive value of the crops they produce, are unknown, though their immediate effects may appear ever so desirable.

STOCKING OF TANKS[1]

By Sunder Lal Hora, D.Sc.
Director of Fisheries, Bengal

THE first thing to be done in stocking a pond is to be sure that there are no predatory fish in it, but it is very difficult to be sure of it unless the pond is dried up and partially desilted.[2] The bed should then be properly manured and a crop raised on it. Thus cultivation of the bed of a pond will not only ensure the destruction of all predatory fish but would leave the bottom more full of insects and other organisms which will form good feeding for fish when the water is turned in.

Precautionary measures

In filling the pond with water, care must be taken that fry of all sort of fish do not indiscriminately find their way in. Only selected fish, such as the fry of *catla*, *rohu*, *mirgal*, *calbaus* or other local fast-growing species of Labeos and Barbus (Carps and Barbels), should be stocked in the pond. Thus there should be in it only those species which do not prey on each other and which would more or less feed differently so that there is little competition for food among the various species stocked together.

Before introducing fish in the pond, be sure of the presence of live food in the pond. A few handfuls of water snails thrown in will soon multiply astoundingly and make good food for the coming fry. The minute young snails form excellent food for fry while the larger ones are devoured by the half-grown and mature fish. Suitable aquatic vegetation should also be planted and proper manuring done to ensure the rich growth of plankton. If the water turns slightly green, it is good for the fry as it indicates rich growth of phytoplankton.

Another precaution necessary in the case of stocking pond is to make suitable provision against escape of the fish by the overflow Gratings can be used for this purpose, but unless they are very fine they will not prevent the escape of fry. Fine gratings are, however, likely to be choked with debris. To obviate all these difficulties, Thomas[3] has described a simple mechanism which may be adopted, if found necessary.

Number of fish per acre

A question that is often asked is regarding the number of fish that can be stocked in the pond of a given size. In this connection no hard and fast rules can be laid down, because this depends chiefly on the nourishing power and not on the size of the pond. The rich or superior ponds must be stocked heavier and the poorer or inferior ponds lighter. In order to achieve the desired object, each pond must be stocked according to its capacity to provide the fish with what is required. This means that each pond must be studied for a few years and its actual capacity determined for the growth of fishes. A few general hints may, however, be given here by way of guidance.

Describing the practice of carp-growing in Germany, Nicholson[4] states that in nurseries fry of six weeks to 2 months old are placed at the rate of about 12,000 to the acre.[5] ' After a few weeks the food remaining in the pond is insufficient for the growing survivors, and they are therefore turned into larger and deeper ponds at the rate of 500 per acre, and thence again into larger ponds. The system is desirable only where the waters are not incessantly and largely under renewal, are not rich in natural food and are not supplied with artificial food; otherwise the periodic transference is unnecessary, since it is merely adopted to regulate the food supply which enables the

[1] The object of writing these articles is to invite suggestions and criticism with a view to codifying the existing information for the benefit of pisciculturists in India and for the proper development of the vast inland fishery resources of the country.

[2] This silt as well as mud from the bottom of canals, etc. is a very good manure for agricultural fields. It is extensively used by the Chinese for fertilizing their lands (see F. H. King's *Farmers of Forty Centuries, 1927*).

[3] *Rod in India*, 3rd edition, p. 344 (London, 1897).

[4] *Madras Fish. Bull.* Vol. XI, pp. 154-155 (1917).

[5] C. B. Hall (*The Culture of Fish in Ponds, Bull. No. 12, Ministry Agric. & Fish.*, p. 16, London: 1930) gives the following figures of pond capacity for good results :— 40,000 fry per acre; 1,050 to 2,000 yearlings per acre (each 1/4th lb. in weight) 520 to 800 two-year-olds per acre (each 1 lb. to 1½ lb.) and 300 three-year-olds per acre (each 2 lb. to 2½ lb.)

fish under this system to grow twice as quickly as they do in ponds under the ordinary system and to be more healthy, since they are not starvelings crowded promiscuously together but well fed carplets with plenty of room and nourishment.'

In Bulletin No. 2, Department of Fisheries, Bengal (p. 3, 1913), it is stated that 'A tank 50 ft. long by 50 ft. broad and 10 ft. deep is large enough to give liberal support to 2,000 fry or young fish 1 in. long, for from 4 to 6 months but, at the end of this time most of the fish must be transported and distributed to other tanks in order to prevent overcrowding.' In Bulletin No. 13 of the same department, Prashad (p. 5, 1916) recommends that in a hatchery tank (8 ft. square and 1½ ft. deep) the tiny fry should be stocked at a rate not exceeding 1,500 per cottah (30 ft. × 24 ft.). ' On the fry growing to a size by an inch in length they should be distributed from the first tank into others[1] because they will then require larger quantity of food. The number at this time should be reduced to a thousand (1,000) per cottah. The young fish may be left in these tanks till they grow to a size of 5 to 6 inches, when they can finally be transferred to the stocking tank '. De suggests that ' Not more than 200 fry should be put into every 100 cubic ft. of water.[3] This rate will give the fry sufficient space to swim about, but the character of the water alone, i.e., the quantity of microscopic food it contains and can grow, will determine the number that can thrive well, and this is to be ascertained in every case by experience '. In the stock tanks, he recommends putting 2 fish for every 100 cubic ft. of water and remarks that ' This rate may, however, be varied by actual experience of the growth of the fish therein, which depends upon the quantity of natural food in the tank '.

According to some authorities a gallon of water per fry or a litre per gram of fish weight is a suitable criterion for making calculations regarding the number of fish that should be stocked in tanks. As a general rule a tank produces the best results when it is stocked according to its natural or added fodder store.

Advantages of transplanting fry

From all the accounts referred to above, it will be seen that transplanting of young fish at different periods of growth is desirable for good results. Very small fry require shallow, warm water and plenty of microplankton for their proper development. The fingerlings should be reared in nursery ponds not more than 4 to 5 ft. deep while only young fish of 4 in. to 5 in. in length should normally be stocked in the larger and deeper tanks. These transplantations are not only beneficial for the proper feeding of the fish, but provide occasions for giving the fish some exercise and improving the general hygienic conditions of the fishery ponds by dragging them with nets. If at the time of transferring fish from one pond to another a salt bath (0·2 per cent solution of common salt) or a bath in potassium permanganate solution (½ grain by weight to a gallon of water) is given to the young for 5 to 15 minutes according to the vitality of the individuals to be treated, it will prove beneficial for the healthy growth of fishes. All kinds of fungus growths and external parasites are killed and the chances of further infection in the stocking tanks are greatly eliminated. The fry and young fish should be very carefully handled at the time of transferring them from one pond to another and sickly and injured specimens should be removed or properly treated before putting them into stocking ponds.

[1] Rearing tanks, 10 ft. long, 8 ft. broad and 4 to 5 ft. deep.

[2] *A Few Hints on the Culture of Fish in Tanks in Eastern Bengal and Assam*, pp. 4-5 (1936).

[3] In such calculations, water below a depth of 6 to 8 ft. should not be taken into consideration as it is practically devoid of all nourishment.

YOKES AND YOKE GALLS IN CATTLE IN INDIA

By Chaudhri Mushtaq Ahmad, P.V.S.

Punjab Veterinary College, Lahore

YOKES and yoke galls together form a most important chapter of incidence in the life of the average cultivator of this country; the one is the cause and the other the effect, and although there is no immediate resemblance between them, there is a relationship which is inseparable and almost simultaneous; for without the yoke, there cannot develop anything like a yoke gall from any other causal agent. But however, all this may be, yoke galls and yokes, as they exist today take on a historical and even archaic background. Yoke galls have followed the use of yokes for centuries and to only our occasional surprise and regret without any great effort on our part to remedy either.

'The yoke is easy and the burden light,' expresses in a single cryptic phrase, the practical though potential aspects of the prevention of this condition of yoke galls; for an 'easy' yoke spells comfort or freedom from undue friction and a 'light' load means fewer painful jars to the neck and a consequent relief from severe but incontinuous pressure, from painful injuries and prolonged convalescence of working animals so affected.

It must therefore be conceded that both the form and shape of the yoke and the weight and balance of the load play the most crucial parts in the role of prevention of yoke galls in working bullocks. The following notes may help to construct a reasonable system of putting bullocks to the yoke under better conditions than heretofore and of dispelling once and for all time the traditional ideas of what a good yoke means economically and in the interests of humanity.

Farmer's powerhouse

The yoke and plough are the be all and end all of an Indian agriculturist's machinery. A yoke is an implement made of wood to secure draught animals at the neck either singly or in pairs for all agricultural operations and is necessary for the agriculturist because, unlike the West, his power house lies in his draught animal. 'The old order changeth yielding place to new' has been a general rule in the world, but it seems that our yoke, as it is, 'will go on for ever'. The form and structure of the yoke have undergone very little change from the original straight bar design, with its many attendant serious disadvantages, both to the farmer and the animal. The reason for this is not far to seek. It is either that an Indian agriculturist does not welcome a change in his methods, which are often based on tradition and superstition, or that very little attention has been paid to this problem up to the present time. I, as a *bonafide* agriculturist, have realised the economic loss to which the farmer is being daily subjected to owing to this primitive type of yoke, because straight bar yokes are seldom unassociated with yoke galls, all of which means a reduction in the working power of the animal. Yoke galls are the commonest injuries with which a veterinary surgeon is confronted with in an agricultural country like India, and, common as they are, they are likewise serious. Besides being a source of loss of time and energy to the farmer, in addition to cruelty to the animal, the present day yokes show a definite want of ingenuity and skill on the part of man to improve their form and structure. But there is no doubt that the farmer must share the responsibility for the frequency and occurrence of these yoke galls. His ignorance, coupled with carelessness, have aggravated this state of affairs.

Yoke galls

The importance of this problem and my dual interest in it as an agriculturist and as a veterinarian have made me investigate the subject for some time past, which has resulted in finding an approach to the problem from two directions. In the belief that prevention is better than cure, I have tried to minimise the occurrence of yoke galls by visualising a new type of yoke which would

distribute the pressure equally over the neck muscles, thereby reducing the friction and pinching to a great extent. The result has been the innovation of the 'Universal Double Yoke', which, besides being portable and adjustable to all sizes of necks, can be used in almost all kinds of agricultural operations.

No book on surgery has done, to my mind, sufficient justice to the subject of yoke galls; this may be because the problem does not protrude to such an extent in other countries as it does in India.

My experience of some 29 years in the profession has enabled me to evolve a method of treatment of yoke galls which has been carried out by me in very many cases with great success.

The term yoke gall includes injuries of any kind, degree or condition, caused by yoke upon the neck of the yoked animal.

Causes of yoke galls

The reason why the neck has been selected for draught purposes in cattle perhaps is that the neck of the ox and buffalo in India is short and thick as compared with that of the horse. Below are given main causes of yoke galls:

1. continuous pressure.
2. continuous friction.

These may be brought about by any of the following:

1. Faulty conformation of the yoke.

(*a*) The old straight bar yoke which concentrates pressure only upon the dorsal aspect of the neck (Fig. 1).

(*b*) Misfitting yoke, when its size is unsuitable for the animal.

(*c*) Pinching of the skin of the neck by the yoke.

(*d*) Rough yokes with uneven surfaces.

2. Ploughman's carelessness coupled with ignorance:

(*a*) Maladjustment of the yoke.

(*b*) Working the animal beyond its capacity.

(*c*) Working a newly broken animal too severely.

(*d*) Ploughing dry and hard land without watering it.

(*e*) Working animals when it is raining.

(*f*) Working animals hard when they are in soft condition particularly after the rainy season.

(*g*) Working the animal without applying a muzzle. In this case the animal in yoke tries to reach the green grass which happens to be in his way, and bending down he pulls at the grass, causing the yoke to strike hard on the neck, resulting in yoke galls.

(*h*) Improper balancing of the load so that more weight falls on one animal producing a gall.

(*i*) Putting in the same yoke two animals of different size. When the two animals are not of equal height, more weight falls upon one.

(*j*) Maintaining the weight and pressure upon the neck of the animal continuously for a considerable length of time.

(*k*) Rough handling of the animals at the time of turning. The ploughman pressing the plough hard by his foot which consequently buries deep and causes great strain upon the neck of one of the yoked animals.

3. Faulty conformation of the neck of the yoked animal.

(*a*) Thin and long neck.

(*b*) Thin skinny neck.

(*c*) Neck not properly developed. This is seen in those instances where calves are castrated at an early age.

Yoke injuries

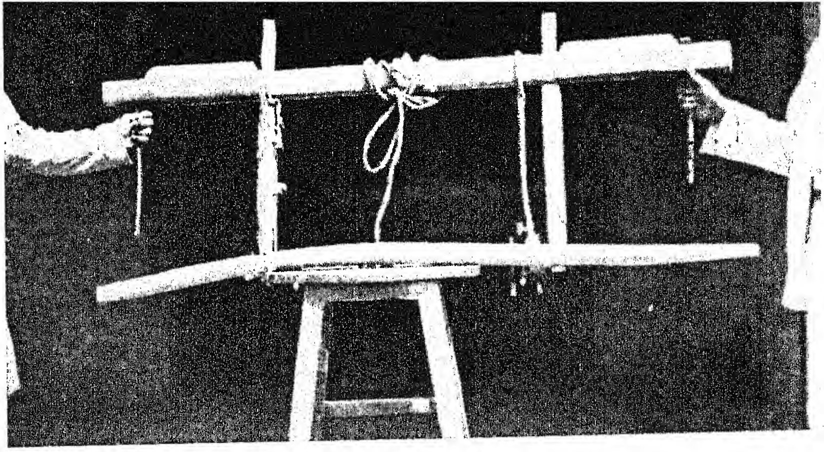
Yoke injuries may be classified into three groups:

1. *Open wounds.* These are injuries in which there is a breach in the continuity of the skin and may be also of muscular tissue.

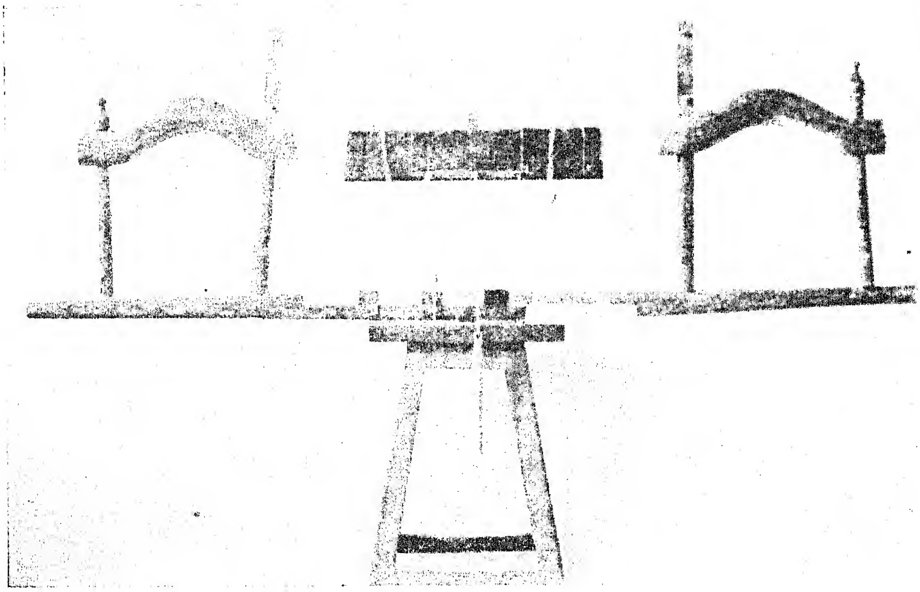
2. *Contusion.* This is the group in which the skin and underlying structures are injured without any breach of continuity in the skin.

3. *Sprains.* This is a group comprising injury to deeper structures, such as muscles and ligaments with complications.

(1) A gall can best be studied when the animal is unyoked. First there is a raw hairless surface which is inflamed. The part becomes hot and painful throughout, the inflammation extending to the neighbouring tissues, with the result that the animal shows



IG. 1. Old fashioned Straight Bar Yoke.



G. 2. Mushtaq's Universal Portable Double Yoke.

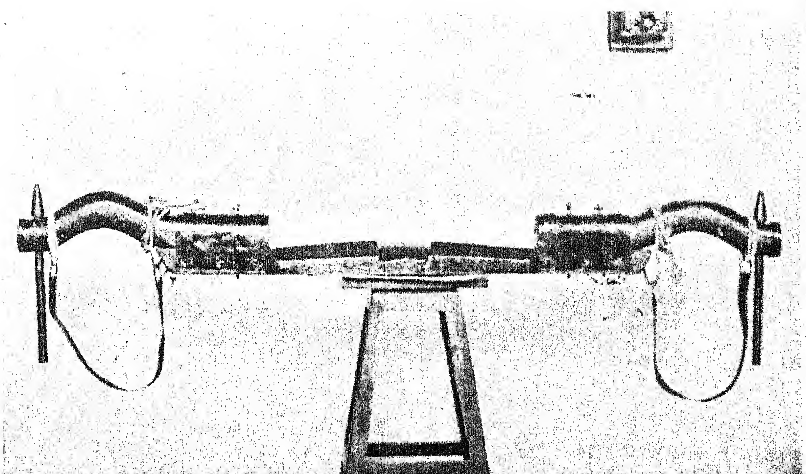


FIG. 3. Double yoke for bullock and water cart.

PLATE 16

pain and difficulty in moving or bending the neck. If neglected, the condition becomes aggravated. Sometimes, the skin over the injured area becomes necrosed, not unlike a 'sit-fast' in horses. The condition is further aggravated by flies which find the wound a suitable 'forcing house' as it were, for laying their eggs, which, in a short time, make their appearance as colonies of maggots. Crows and other birds find this site an easy place at which to peck and cause further injury. When the ignorant owner experiences difficulty in showing his animal to some veterinarian, either due to pressure of work or distance from the nearest dispensary, he resorts to his own treatment. He not only tries all local medicines he can lay his hand upon, but also seeks advice from his fellow farmers. He applies lime, pure phenyle, caustic leaves, the secretion of calotropis plant, kerosine oil, soot, powdered tobacco, chillies, etc. Owing to the constant use of these irritants the gall changes into an indolent ulcer with the formation of a tumour. The healing of such an ulcer is very slow and protracted.

(2) In contusions the part becomes hot, tense and painful to the touch and a huge swelling appears within 24 hours of the infliction of the injury. This inflammation indicates that either a blood tumour has been produced, or that an abscess is developing, which may later burst. If infection does not take place, and the animal is rested, healing takes place resulting in the formation of a scar.

More often acute inflammation sets in, tension increases, and the skin bursts, and gives rise to a large and deep ulcer. Bursting of the abscess does not usually provide proper drainage for the pus, which may burrow deep into the surrounding tissues resulting in the formation of a sinus.

(3) Sprains of ligument and adjacent muscles. When such injury takes place, it is accompanied more or less by local contusion. The animal under yoke shows uneasiness, is unable to bear weight, and tries to evade the yoke. When unyoked, the neck within a short time becomes swollen and painful, so much so, that the animal cannot bend his neck to pick up food. If this condition be neglected, it leads to similar complications mentioned under contusion.

Prevention of yoke injuries

The simple and easy methods given below, of prevention of these injuries should enable the owner in time to appreciate their value and put them into practice :

(1) The form and structure of the yoke must be such as to distribute the weight and pressure evenly, not only on the dorsal but on the lateral aspects of the neck. Friction should be reduced to a minimum and also avoidance of pinching of the skin under the yoke. With these objects in view the author has improved the old pattern of yoke as shown in figures 2 and 3.

(2) The ploughman should see that the yoke is properly adjusted to the neck of the animal before commencing work, and that the yoke, as well as the yoke bar, is free from dust and grit.

(3) Immediately after unyoking an animal, it should be the first concern of the ploughman to examine its neck. If any injury is detected it should be treated immediately, and the animal rested until fit to resume work. The next step is to locate the cause of the injury, and attend to its immediate removal in order to avoid recurrence.

(4) An animal should not be worked until exhausted. Four hours on a Persian wheel for instance, in a district where the water level is fairly deep is more than sufficient.

(5) An animal should not be worked while it is raining. In such case the skin contracts and becomes wrinkled, forming an uneven surface for the yoke to play on with the inevitable formation of a gall, also friction is increased.

(6) Animals should be muzzled during work.

(7) The equi-balance or weight should be attended to, in heavy carts especially.

(8) When an animal is broken for the yoke, it is advisable to wash or foment his neck with alum or salt solution or a decoction of acacia bark (1 in 20) after work.

(9) Animals should not be worked hard after they have been off work in the rainy season, as during this period they get into soft condition.

THE ROLE OF FALLOWING UNDER DRY FARMING

By

DALIP SINGH, M.Sc. (Pb.), Ph.D. (Cantab)

Agricultural Chemist, Punjab Agricultural Research Institute, Lyallpur

and

SUKH DAYAL, B.Sc. (Hons.), M.Sc.

Soil Physicist, Dry Farming Research Station, Rohtak, Punjab

SOIL, if not manured, shows signs of exhaustion under a continuous system of cropping. Therefore, one of the methods followed for its recuperation is to keep it fallow. Fallowing, in strictly agricultural sense, means leaving the land out of cultivation during the cropping season when ordinarily a crop can be obtained. The value of this method for restoring soil fertility has been known to the cultivator for a very long time, but its importance in the conservation of soil moisture under dry farming conditions has not been fully realized. In areas of low rainfall, where intensity of cropping is not high, soil moisture is of greater importance than soil fertility. The extent to which fallowing is helpful in conserving soil moisture, and its effect on successful cropping under dry farming conditions have been investigated with the following results.

Conservation of soil moisture

When rain falls on a bare field, greater portion of it travels through pores and crevices into the subsoil, and is held up there as a thin film round the soil particles. The depth to which this penetration takes place depends on the intensity and amount of rainfall, climatic conditions and the type of soil. Under the conditions prevailing at the Rohtak Dry Farming Station, the rain water during years of normal rainfall is able to penetrate, even to a depth of 10 ft., in a field under ordinary system of cropping. During the hot months from March to June there is an intense loss of moisture due to evaporation, but these losses are considerable only from the surface foot. Out of the total moisture lost due to evaporation from a 6 ft. column of soil, 75 per cent comes from the surface foot. Moisture below second foot remains more or less intact, and can be utilized by the crops. Generally, the crops depend for their water supply on the first 6 ft. column of the soil, but the depth from which different crops draw their moisture varies with the nature of the crop, climatic conditions, and the type of the soil. A plant like cotton is able to send its roots even to 10 ft. depth, and greatly depletes the soil moisture of that zone. Water thus utilized by crops is made good by subsequent rains, but the experiments conducted at the Research Station have shown that the rains of one season are not enough to replenish the soil moisture in lower depths, and it is therefore necessary to give the land longer than normal period of fallowing. As already observed most of the rain water which goes below the surface foot is not lost by evaporation, but can be carried over to the next season if the land is kept fallow and the crop in the following season gets the benefit of the rain water of two seasons. Therefore, *bajra* sown in fallow fields gave nearly double the yield of what was obtained from fields cropped every year (figs. 1 and 2). Similarly in 1938, when rains totally failed and no crop could survive, *guar* in the fallow plots yielded 214 lb. per acre as against 26 lb. per acre from the cropped plots.

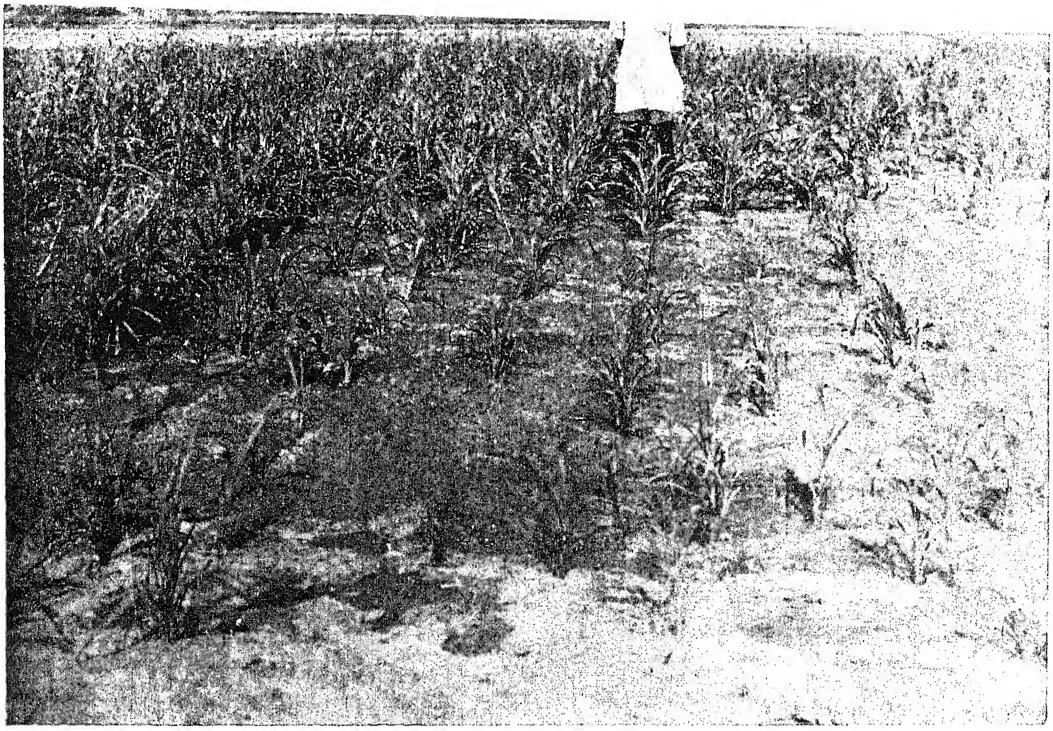
Rainfall in inches

1937	1938	1939	1940	1941
18·44	8·64	9·30	16·96	16·83

Moisture percentage in a 6 ft. column of soil in the plots, sown every year with a crop (100 per cent intensity) and kept fallow during one rainy season is given in the table below:

Intensity of cropping	Percentge on oven dry soil 1937	1938	1939	1941
(1) One crop every year (100 per cent intensity)	9·08	9·06	9·08	9·43
(2) Two crops in three years (66 per cent intensity)	13·85	11·41	10·32	14·09

Thus, there is always more moisture in the fallow plots than in the cropped plots, and it was due to this deep seated moisture reserve that a fair crop was obtained from these plots



Effect of fallowing on crop growth. *Bajra* after crop (top). *Bajra* after fallow (bottom)

during the famine years of 1938 and 1939, when not a blade could be raised from the plots cropped every year. In the fallow plots there are 137 to 500 tons more water per acre than in the cropped plots, and the quantity is enough to produce about 225 to 892 lb. of *bajra* grain.

Soil fertility

It was observed that soil fertility is also affected by fallowing. The results of analyses show that the fallow plots are more fertile, and contain more available phosphorous, potash, and nitrogen (available and total) than cropped plots. *Bajra* grain from fallow plots contained about 0·3 per cent more nitrogen.

Crops on fallow plots draw comparatively more moisture from deeper layers. *Bajra* in cropped plots obtains more than 50 per cent of its total requirement of water from the first foot layer, while in the fallow plots it draws about 25 per cent from the first foot the remaining 75 per cent is taken up from the lower layers.

Necessity of a clean fallow

Weeds greatly desiccate the soil of its moisture, and reduce the moisture content to such a low level as to inhibit the growth of a crop. The distribution of moisture in a plot kept free, free from weeds,a nd that in which weeds were allowed to grow, is given in the table below:

Moisture as percentage on oven dry soil (Before break of monsoon on 31 May 1940)

	0-6 in.	6-12 in.	2nd ft.	3rd ft.	4th ft.	5th ft.	6th ft.
Weeded	3·55	7·86	12·44	13·11	12·58	10·77	8·22
Unweeded	1·54	4·71	6·49	7·71	7·64	5·15	3 50

Fallow plots clean of weeds contained 532 tons more water in a 6 ft. column of soil per acre than weeded plots, and this quantity of water can produce about 1,600 lb. of dry matter of *bajra*. Such a huge loss of moisture, equalling to about 5 in. of irrigation, and capable of raising 20 md. of the crop, can be saved if the land is kept free from weeds. It is useless to keep the land fallow if it is not kept free from wild growth. Due to this clean fallowing, it was possible to obtain fair yields of crops at the Research Station in the years 1937 to 1939, when the zamindars' crops entirely failed. The year 1938 was very dry, and the cultivator could not sow a crop. Thus, he was forced to keep his land fallow during this period, but since he did not keep the land clean of weeds, in 1939, also, he could not obtain any crop though the season was comparatively much better. On the other hand, at the Research Station, due to the practice of clean fallow, crops were very satisfactory during the same year.

Recommendations

A *barani* cultivator is an opportunist. Whenever there is a good shower of rain about the end of June or the beginning of July, he sows the entire area with *kharif* crops, reserving no area for the *rabi* crops. If again there are good showers about the end of August or the beginning of September, he harvests his *bajra* at that stage (whether fully ripe or not) and prepares the land for *rabi* crops. He is not concerned with the idea that if winter rains fail, he will not be getting any *rabi* crop at all.

A cultivator in a *barani* tract can ensure his crop against famine, by putting his holding under a proper system of rotation, in which fallowing finds a definite place. Thus, every year some portion of his holding remains out of cultivation. The period for which land may be left fallow will depend on the quantity and distribution of rainfall, climatic conditions, and the type of the soil. Under the conditions prevailing at Rohtak, it is enough to keep the land fallow for one rainy season only. In other words, *bajra* can be raised every alternate year from the same field.

During the period the land is lying fallow, it is of paramount importance that it should be kept free from weeds. For this purpose, a harrow or hoe can be conveniently used, and this will greatly facilitate the subsequent cultural operations, which will be done in much less time than when a *desi* plough is used. The land should be worked only for the sake of removing weeds, and the soil should not be pulverized to a fine state. During the fallow period, the use of levelling beam is to be avoided.

LIVE-WEIGHT OF GOATS BY MEASUREMENT

By D. L. Paul, I.D.D., Assoc. I.D.I.
Agricultural Inspector, Livestock, Assam

Breeders and dealers in livestock are constantly faced with the problem of knowing the live-weight of their animals. This problem appears in many ways in the case of goats, since they are used for milk and meat. The live-weight is an important factor in scientific feeding for efficiency and economy, and it is an indication of size which plays a great part in the commercial valuation of goats.

But the weighing of animals requires comparatively costly weighing machines which are inaccessible to the average Indian farmer, especially in small bazars, where the actual valuation takes place. Therefore, a simple formula for arriving at the approximate weight of the goat can be of great use.

Formula for weight of cattle

There are certain formulæ which are used for estimating the approximate weight of cattle, horses, etc., from certain body measurements. These formulæ are applicable more to cattle and other big animals than to goats.

One of the old text-book formulæ is $\frac{G^2 \times L}{300}$ = approximate live-weight of animal in pounds when girths and lengths are measured in inches.

Macguckin suggested a formula, Girth^2 $\times$ length $\times$ 5·5 = Live-weight of animal in pounds, when girths and lengths are measured in feet; this has been found to work fairly well in case of large animals, but it does not give satisfactory results for goats.

The second formula seems to be an improvement on the first one as $\frac{G^2 \times L}{300}$ (girths and length being measured in feet) comes to $G^2 \times L \times 5{\cdot}7$.

In the case of 114 goats which were measured and weighed for the purpose of this paper, when actual live-weight is compared on the Macguckin formula, G^2 (in feet) $\times$ L (in feet) $\times$ actual live-weight in pounds, the average value of X comes to 5·7 and not 5·5 as shown below:

$$X = \frac{\frac{\text{Actual weight in pounds}}{G^2 \times L}}{\text{N (number of cases)}} = \frac{652{\cdot}8}{114} = 5{\cdot}7$$

Hence the old text-book formula stands nearer the actual weight than Macguckin formula, nevertheless, neither of them comes so close as the new one (Table I and II).

Sodhi Gambhir Singh described the new formula stated below as having a better result for (small) cows of the Montgomery breed of the Punjab:

$\frac{G \times L}{X}$ = Live-weight of animal in seers.

G = Girth of the animal in inches.

L = Length of the animal in inches.

X = 9, when girth of the animal is below 65 in.
= 8·5, when the girth of the animal is between 60—80-in.
= 8, when girth of the animal is above 80-in.

None of these formulæ gives satisfactory results for small animals such as goats. Consequently the writer has devised some new formulæ more applicable to goats.

Weighing methods

In sampling animals for investigation, goats—male, female and castrated of different sizes and breeds, i.e. local, Jamana Pari and cross bred, were selected numbering 114 in all. Small animals having girth below 15 were excluded. Measurements were taken of the girth and the length of the body. Length represented the distance between the point of the buttocks and the point of the shoulders and the girth was taken just behind the shoulder to represent the circumference of the body. For lengths, animals were measured from both sides and mean of the two measurements recorded. The girth readings were taken by allowing the animal to stand at ease to eliminate the effect of the different attitudes assumed by the animal at the time of measuring. These points have been marked in the diagram showing the girth and length of the body (Fig. 1).

New formula for weight

The actual weight of the animals was taken on a platform scale and recorded. From these data, the value of the X used in both the new formulæ was determined as stated below:

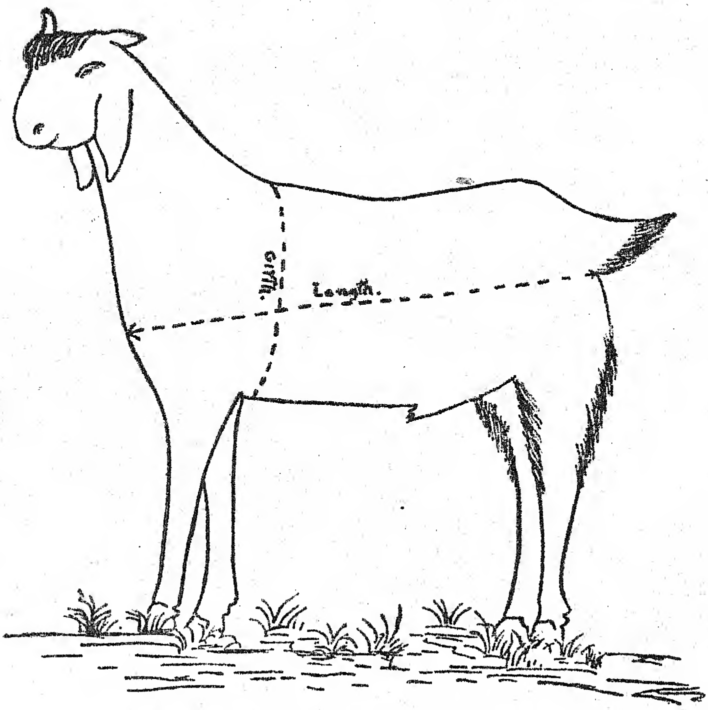


Fig. 1—Showing the girth and length of the body.

New formula No. I : Girth of the animal in inches X its length in inches = the curved surface area of its body. This curved surface area was divided by its actual weight to find out the number of square inches of the area which was required to give 1 lb. of live-weight *vide*—Sodhi Gambhir Singh's method.

New Formula I.

$$\frac{G \times L}{X} = \text{Approximate live-weight of the animals in pounds.}$$

G = Girth of the animal in inches.

L = Length of the animal in inches.

X = 17, when girth of the animal is between 15 to 19 inches.

= 13, when girth of the animal is between 20 to 25 inches.

= 11·5, when the girth of the animal is above 25 inches.

Example :—The girth of a goat was taken to be 17 inches and its length 16 inches and the actual weight by weighing machine being 16 lb. : The live-weight according to the new Formula I was found to be

$$\frac{17 \times 16}{17} = 16 \text{ pounds.}$$

New formula No. II : The square of the arithmetic mean of the girth and length was taken as curved surface area of the body and then divided by the actual weight to find out the value of X. This number was determined for goats of different girths and has been represented as X in both the formulæ.

As live-weight determination by the curved surface area method has been found more acceptable than by the volume method the new formulæ have been evolved on the curved surface area principle.

New Formula II.

$$\frac{\left(\frac{G+L}{2}\right)^2}{X} = \text{Approximate weight in pounds.}$$

G = Girth of the animal in inches.

L = Length of the animal in inches.

X = 17 when girth of the animal between 15 to 19 inches.

= 13·5 when girth of the animal between 20 to 25 inches.

= 12 when girth of the animal above 25 inches.

Example : $\dfrac{\left(\dfrac{G+L}{2}\right)^2}{X} = \dfrac{(16\cdot5)}{17} = 16\cdot01$ pounds

The results obtained from the old text book formula and both the new formulæ are given below for comparison *vide* Table I, II and III.

TABLE I—(SUMMARY).

Total Number of animals.	Average actual weight in lb.	Average variation of the estimated weight from the actual weight expressed as a percentage of latter.		
		By new Formulae.		By old Text-Book Formulæ.
		I	II	
114	38·38	8·46	7·79	9·22

Average variation has been found by adding differences between estimated weights and actual weights of the goats disregarding their signs (plus or minus).

From the summary above, it is clear that the new formulæ give better results than the old Text-book formulae. The new formula II being the best.

TABLE II

Showing the degree of accuracy of the new formulæ evolved by the writer to determine the weight of goats by measuring them and its comparison with the best known one.

No. of Formulæ.	Form of the Formulæ	No. of Goats	Total actual weight in lb.	Total variation of the estimated weight from the actual wt. in lb.	Average variation of the estimated wt. from the actual wt. expressed as p.c. of the latter.
I.	$\dfrac{G \times L}{X}$ = Live-weight in lb. X = 17, when G = 15″—19″; X = 13, when G = 20″—25″; 11·5, when G = above 25″	114	4375·5	370·53	8·46
II.	$\dfrac{\left(\dfrac{G+L}{2}\right)^2}{X}$ = L Wt. in lbs. 17, when G = 15″—19″; X = 13·5 when G = 20″—25″; 12, when G = 25″ and above.	,,	,,	340·93	7·79
III.	$\dfrac{G2 \times L}{300}$ = Live-weight in lb.	,,	,,	403·50	9·2

THE LAWS OF HEREDITY

THE same with plants—potatoes 'tatoes breed—
Uncostly cabbage springs from cabbage seed;
Lettuce to lettuce, leeks to leeks succeed;
Nor e'er did cooling cucumbers presume
To flow'r like myrtle, or like violets bloom.

—*The East African Journal*, January 1944.

BAJRA CROP IN SOUTH-EASTERN PUNJAB

By I. M. Rao, M.A., M.Sc.

Plant Physiologist, Punjab Dry Farming Research Station, Rohtak, Punjab

Bullrush or 'Pearl' Millet, known locally as *bajra*, forms one of the main-staple crops of the South-Eastern Punjab, comprising the three districts of Rohtak, Hissar and Gurgaon. It occupies about 1·6 million acres of land in this tract (52 per cent of the area under *bajra* crop in the province) and almost the whole of it is grown under rainfed conditions. It is extensively cultivated as a staple crop in other parts of India too. The crop is always grown during the *kharif* season (June to October). The dry stalks serve as fodder for the cattle.

The South-Eastern Punjab is frequently menaced by severe famine conditions due to failure of rains, causing great hardship to the people and cattle and necessitating expenditure of large sums of money by the Government on relief works. In order to discover methods for growing crops successfully in this area, detailed investigations ha e been carried out since 1935 at the Punjab Dry Farming Research Station. Results, so far obtained, enable the recommendation of improved methods which are within easy reach of the poor *barani* (dry farming) cultivator. A few details regarding the physiological behaviour of *bajra* crop and methods for successful cultivation of the same are described below.

Factors affecting crop

Climate : The average annual rainfall at Rohtak for the period 1935-41 was 15·09 in., most of which came in during the *kharif* season. The monsoon begins during the second fortnight of June and is over by the first fortnight of September. It is followed by a rise in temperature and by dry westerly winds. The extremely erratic nature and the poor distribution of the otherwise low rainfall are the main sources of crop failure. *Bajra* is sown in June with the break of monsoon. It experiences intermittent long spells of dry weather during its growth, and continuous drought during the earing and maturity period.

Soil : *Bajra* is usually grown in light loam soils. Heavier soils are not suited to this crop. The soils of this tract are alluvial and deep. The soil should be opened with a deep plough (a soil inversion plough, if available, but this is not essential) before the break of monsoon to enable the destruction of weeds and keep the land cloddy for better absorption of rain water. With the first good showers of rain, the land is prepared by running a heavy beam (*sohaga*) to break the clods and by cultivating with a country plough. The seed is dropped in furrows formed by a plough and a light beam is passed to cover up the furrows. Two or three hoeings during the crop growth are necessary to remove the weeds and to improve æration of the soil which is essential to root-growth in *bajra*.

The cultivator does not usually prepare his land before sowing and so his fields are fully infested with perennial weeds like *ber* (Zizyphus jujuba) and *dhab* grass (wild Saccharum), and the rain water collects at lower levels. With difficulty the cultivator gives one hoeing to the crop ; thus his land remains full of weeds competing vigorously with the growing crop.

Manure : As water is the main limiting factor for crop growth under rainfed conditions, it is harmful to use artificial manures. Farmyard manure can be useful when applied in low doses i.e., 3 to 5 tons per acre ; higher doses make the crop more leafy and susceptible to drought.

Previous crops : A properly balanced cropping system is one of the essential requirements of dry farming. The rainwater preserved in the soil should be economically utilized for crop growth to enable the cultivator to mature at least a portion of his crop even under severe drought conditions. Keeping the land under clean fallow for one year before sowing *bajra* results in better growth and maturity of the crop than when it is sown after gram (Cicar arietinum) in the previous *rabi* (October to April) or after *guara* (Cyamopsis psoralioides) in the previous *kharif*, as shown below

	Bajra after		
Height in cms :	Fallow	Gram	Guara
One month old crop ..	10	8	8
Two months old crop ..	152	111	89
At maturity stage ..	165	132	102
Plants per unit area ..	33	21	20
Shoots per unit area ..	75	54	49
Mature ears per unit area ..	39	17	10

Thus it is advisable to keep a portion of the land under clean fallow for one year. In another portion, it can be grown after gram, the rotation being ' gram—*bajra*—fallow—fallow ' covering two years.

Time of sowing : the seed should be sown with the first good shower of rain in June, preferably in the second fortnight. Earlier sown crop produces more vegetative growth and does not mature normally due to adverse weather conditions during the maturity period. Later sown crop gets a shorter growing period. The cultivator, in his anxiety to cover all his land with *bajra* crop, extends his sowings from June to the middle of August. The late sown crop utilizes the soil moisture but gives very little yield ; the following crop too suffers a good deal if the rains are even slightly below normal. This actually happened to the cultivators' crop in 1940 and 1941 ; the yields were poor in both the years.

Seedrate and spacing : A seedrate of about 4 lb. per acre with rows, about 18 in. apart, gives a good crop of *bajra*. The wider spacing reduces root-competition and also enables better interculture without injuring the plants. The cultivator uses a higher seedrate (6 to 8 lb. per acre) and closer spacing (less than even 12 in.) and his crop suffers during drought periods.

Depth of sowing : Good germination is obtained when the seed is sown at a depth of about 3 in. When sown deeper, the seedling is unable to push through the soil layer. Shallow sowing results in poor germination due to damage by birds or to the drying up of the surface soil.

The cultivator drops the seed through a drill attached to the plough and keeps the furrows open. If the sowing is followed by good showers before the seedlings appear, water accumulates in the furrows resulting in the rotting of the seed. The optimum soil moisture content for good germination of the seed ranges from 8 to 13 per cent on oven-dry basis (water-holding capacity of the soil—about 18 per cent).

Crop varieties

The different types of *bajra* fall into two main groups, the small seed types (early ripening) and the big seed types (late ripening). Detailed physiological studies carried out on an early ripening type, evolved by mass selection at the Research Station, and a late type, A 1/3, are briefly summarized here.

Growth starts early and is more rapid in the early type than in the late one. The ' grand period of growth ' of the early type occurs in August, usually a ' wet ' period, while for the late type it coincides with the post-monsoon drought period. Tillers, both primary and secondary, are freely formed in the early type and most of them mature normally. The early type forms its first ears by the beginning of August, about three to four weeks earlier than the late type ; the latter experiences adverse weather conditions during its earing and maturity period.

The early type has a prolonged earing period, from the beginning of August to the end of September. Thus at least some ears can escape any intermittent droughts that may occur during this period. The earing period of the late type is short and confined to September, when conditions are unfavourable.

Roots of the late type tend to spread along the surface soil resulting in more vegetative growth which cannot be maintained during drought periods due to lack of sufficient roots in the deeper moist layers of soil. The early type has a more balanced root-system regarding spread in the surface layer of soil and penetration in subsoil.

The early type, compared to the late one possesses distinct morphological features characteristic of xerophytism, e.g., smaller leaf-area, larger number of stomata (smaller in size), and higher osmotic pressure of leaf-sap. When plants of both the types were grown under low moisture conditions in the soil, conditions similar to those generally experienced in the locality, the early type transpired altogether (from sowing to harvest) 25 per cent less water than the late type. The water requirement on grain basis, i.e. the ratio of the total water transpired to grain produced, was also lower for the early type, the values, being 1,046 and 1,815 respectively for the two types. The actual performance of the two types in the field is shown below for the period 1936-41.

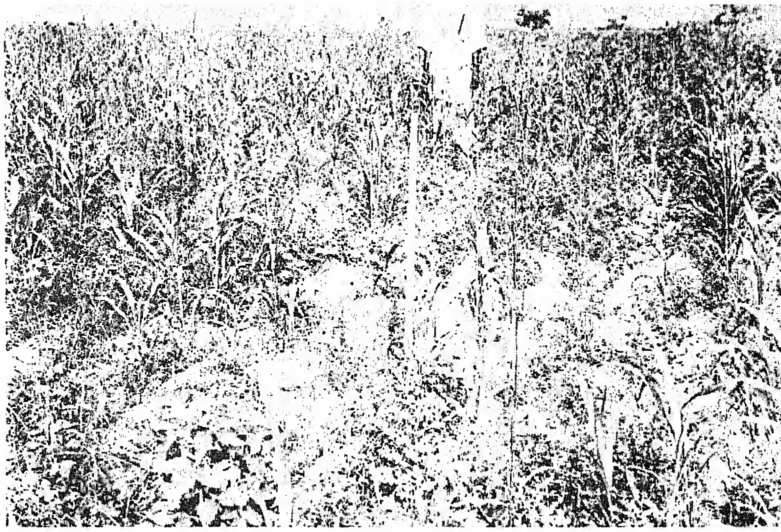


Fig. 1. *Bajra* crop full of weeds. Cultivator's field

Fig. 2. *Bajra* under clean cultivation (*Bajra* after gram)

Fig. 3. *Bajra* after fallow

PLATE 18

Growth and yield of *bajra* (early and late types).

Kharif of	*Bajra* type	Height in cms.	Number of ears per unit area (Metre square)	Yield of grain in lb. per acre.	Rainfall in (May to October)
1936	Early ..	132	46	648	17·55
	Late ..	162	15	549	
1937	Early ..	96	42	382	13·44
	Late ..	145	6	342	
1938	Early ..	64	—	80	6·84
	Late ..	57	Nil	Nil	
1939	Early ..	68	67	521	7·44
	Late ..	86	15	435	
1940	Early ..	154	92	1,707	10·91
	Late ..	226	31	826	
1941	Early ..	135	70	514	13·17
	Late ..	145	37	324	
Mean for six seasons:					
	Early ..	108	63	642	11·56
	Late ..	137	21	413	

Thus it is clear that the early type is better suited to this locality. Dry farming areas in the Punjab as well as Rajputana grow early types but they are low-yielding. The crop is usually called *bajri*, apparently indicating the small size of the seed. People of these areas prefer *bajri* as, according to them, the grain is sweet. Moreover the dry stalks, used as fodder, are relished better by the cattle due to the thin stems.

Recommendations

For growing *bajra* successfully in the South-Eastern Punjab and similar areas in the adjoining districts of the United Provinces and in Rajputana, the following instructions should be adopted:

1. Keep the land in a ploughed condition before the monsoon sets in.

2. With the break of monsoon, prepare the land by two cultivations using the country plough and a beam.

3. Sow in the second fortnight of June. Drop the seed in the plough furrows and cover up the furrows by passing a light beam; use a seedrate of about 4 lb. per acre and keep the furrows about 18 in. apart.

4. Keep the land clean of weeds by giving at least two hoeings to the growing crop.

5. Observe the following rotation: gram (*rabi*)—*bajra* (*kharif*)—fallow—fallow, covering two years. A portion of the land may be kept under clean fallow for one year before sowing *bajra*, as an insurance against famine conditions.

6. Always sow early types of *bajra* which are good yielders.

SOYBEAN HAY FOR PIGS

VETERINARIAN nutritionists report the tests they have made show that good quality legume hays which were formerly considered too bulky for hog feed may actually be used advantageously to reduce the amount of concentrates required for growing and fattening pigs. Soybeans and alfalfa were tested as replacements for concentrates. Ground soybean hay gave the best results when used as 5 to 10 per cent of the total ration. More rapid gains were made on the 5 to 10 per cent levels than when the ground hay made up 15 to 20 per cent of the diet.—*Department of Agriculture, Canada.*

HAEMORRHAGIC SEPTICAEMIA IN BUFFALOES AND CATTLE

By V. R. Rajagopalan

Imperial Veterinary Research Institute, Mukteswar

HÆMORRHAGIC septicæmia, also known in different parts of India as *golghotu, galaphula, galsula, tantikata, thondiadappan*, etc., is an acute infectious disease, mainly of bovines (cattle and buffaloes). Buffaloes are more susceptible to this disease, and the ravages brought about by this disease in this species are sometimes as extensive as those caused by rinderpest. Young animals are the worst sufferers and the majority of the affected animals die. The disease is found in low-lying marshy areas in all parts of India and has a tendency to break out with the commencement of the monsoon or during the winter rains.

Causal organism

It is caused by a minute rod shaped germ, a close relative of which causes fowl cholera in chickens. It is believed that these germs remain in a harmless state at the deeper parts of the nasal passages of some animals and that they obtain an advantage over the host when their natural defensive mechanism gets impaired through malnutrition and exposure to rain or cold. The transition from the harmless to the aggressive stage is favoured in places where there is a great concentration of susceptible animals. It is just possible, though hardly likely that the germ may also thrive in swampy soil where the decaying vegetation supplies nutriment required for its growth, and outbreaks commence where cattle have access to such places. All the factors, which may contribute towards the spread of the disease, are not, however, fully known.

Symptoms of disease

The disease develops very suddenly and rapidly with a high fever and loss of appetite. A swelling of the throat, sometimes extending to the dewlap and breast, is a characteristic and oft-noticed symptom (Fig. 3). The tongue may be swollen. Strings of mucous hang from the mouth. The eyelids, in many cases, are inflamed, and the cheeks are soiled with tears. Blood (hæmorrhagic) spots are seen on the mucous membranes of the nostrils and those lining the body cavities. As the blood becomes septic through the invasion of the germs, the disease is named hæmorrhagic septicæmia. In another form of the disease, the bowels are affected, and there is acute bloody diarrhœa. Sometimes, very young calves die of pneumonia without showing any throat symptoms.

Prevention better than cure

This axiom applies with particular force to hæmorrhagic septicæmia. As the disease comes to a crisis very rapidly, only advanced cases are noticed, and it is almost futile to attempt to treat such cases. For this reason, the prevention of the disease assumes a greater importance.

It is well known that animals which have recovered from a disease caused by a germ are resistant for varying intervals to reinfection with the same type of germ. A similar condition may also be brought about artificially by the injection of a 'vaccine', a product which consists of germs so altered in virulence that they can no longer produce the typical disease. The vaccine may consist of living germs which, in the laboratory, have been made to lose their invasive powers, or of dead germs killed by heat or by suitable disinfectants. In recent years, it has become increasingly evident that to obtain a potent dead vaccine, the structure of the essential parts of the germs, particularly of their surface layers should not suffer by the treatment adopted to kill them. Such a potent vaccine, for the protection of buffaloes and cattle against hæmorrhagic septicæmia, has been evolved at Mukteswar, after an extensive research. It consists of a suspension of the originally deadly germs, killed by the addition of a small amount of formalin. It is so potent that rabbits, which are at least 3,000 times more susceptible than buffalo-calves, have been protected by the use of this vaccine (Figs. 1-2). The dose for cattle and buffaloes is 5 c.c. If practicable, it is advised

FIG. 1. Vaccinated rabbits alive af
artificial infection.

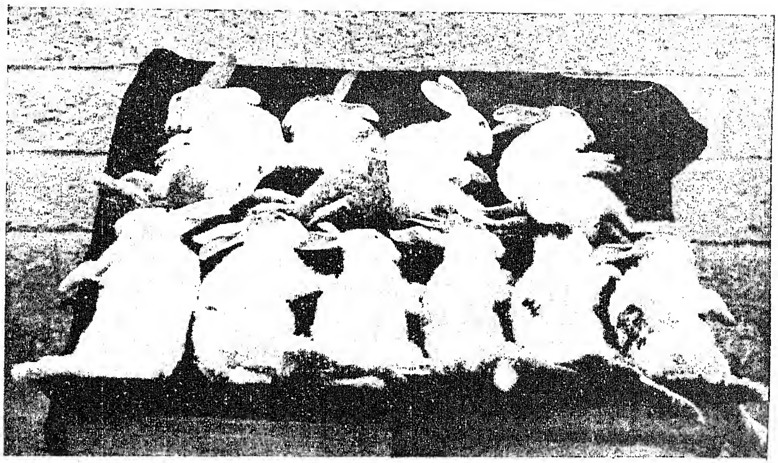


FIG. 2. Unvaccinated rabbits: All te
dead after artificial infectio

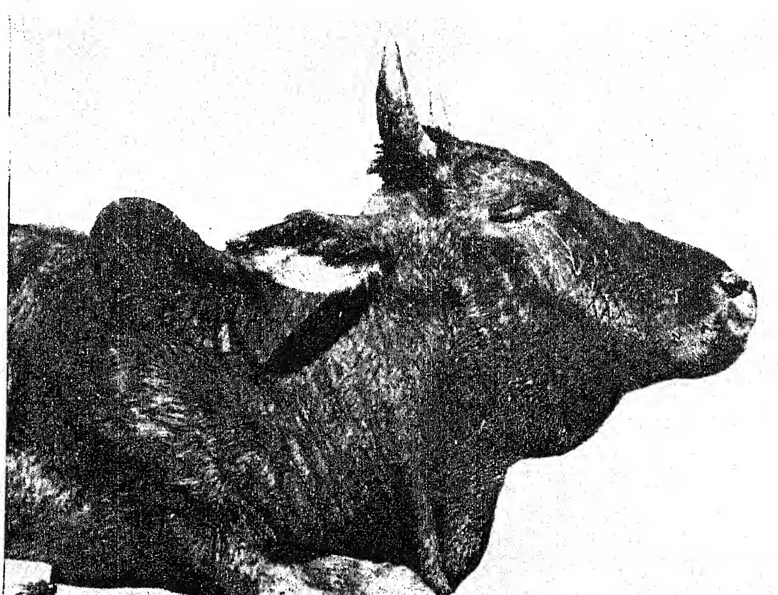


FIG. 3. An infected animal.
Note swelling of throat

PLATE 19

to give a second dose of the vaccine one month later, as this considerably boosts up the immunity.

Yearly vaccination

As the disease occurs seasonally, it can be prevented by injecting the vaccine into animals before the onset of the rains in areas where the disease periodically occurs. It is believed that the immunity may not last beyond one season, hence vaccination should be repeated every year. When the disease has broken out in a farm or a village, one can prevent its spread to other animals by immediately vaccinating all the apparently healthy ones. In such instances some prefer the use of an 'anti-serum' which is also issued by this Institute. This, however, can only be recommended as the second best method, as the immunity conferred by the serum does not last beyond about ten days.

STUDIES OF SHEEP PARASITES

IN a study with 50 ewes and their lambs, the course of naturally acquired untreated nematode infections was recorded, together with the accompanying egg counts, hemoglobins, red and white cell counts and differential blood counts. During the winter months the parasite burden of the ewes dropped to a negligible quantity. In a few individuals complete eradication occurred. The ewes did not pick up any infection until the first warm weather in the spring, underwent self cure in the late spring after passing through a relatively low-grade infection, and maintained a very low level of infection for the remainder of the summer and fall pasture season. The lambs did not become heavily infected until three or four months of age. Clinical manifestations followed infection by three or four weeks. The lambs reached a peak in egg counts very rapidly : this was followed by a rapid decline. This rise and fall in egg counts was accompanied by inverse changes in hemoglobin and red blood cell determinations and by the appearance and partial disappearance of clinical symptoms.—*U. S. O. W. I.*

SUGARCANE MOSAIC AND ITS CONTROL

By B. L. Chona, Ph.D. (Lond.), D.I.C. (Lond.)

Plant Pathologist for Sugarcane Diseases, Imperial Agricultural Research Institute, New Delhi

Of the four virus diseases of sugarcane, namely, Mosaic, Streak, Sereh and Fiji, only the first mentioned is found commonly in India. Sereh and Fiji diseases are absent, while Streak has been observed only on two occasions. First, some years ago, in Uba cane variety at Aligarh; after that, recently on a solitary clump of an indigenous cane, *khosia*, at Pusa.

Discovery of sugarcane mosaic

Sugarcane mosaic, though probably widespread in the past, never attracted much attention until the epidemic outbreak of the disease which played havoc in Porto Rico in 1915-19. This resulted in the discovery that a disease of cane, recorded as early as 1890 in Java under the name of 'Galestrepenziekte' — a yellow stripe disease, recognised as 'degeneration' or 'running out' disease, was really the mosaic disease of cane as understood today.

J. H. Stevenson of the Insular Experiment Station, Porto Rico, was the first to discover the mosaic disease of sugarcane in 1915 and publish its account in Phytopathology in 1917. Lyon of Hawaii thereafter declared that it was the same disease as 'Yellow stripe' disease of Java. Lyon recognised its true nature and proved that it was an infectious chlorosis akin to mosaic virus diseases of plants.

By 1917 sugarcane mosaic was authentically recorded from Hawaii, Fiji, Australia, New Guinea, Java, The Philippines, Egypt, Cuba and Porto Rico. Soon after Argentine and Natal were added to the list followed shortly by India, Formosa, Louisiana, British West Indies and Brazil. Losses which consist of reduction in tonnage and deterioration of juice quality resulting in low recoveries of sugar vary from 5 to 50 per cent, according to various workers.

In India sugarcane mosaic was first noticed at Pusa in 1921 by Dastur and was subsequently recorded authentically in 1926 by McRae. This finding naturally caused a great deal of apprehension in view of the fact that mosaic disease was known to have played havoc with cane crop and brought the cane-sugar industry almost to the brink of ruin in several parts of the world. Consequently, survey tours were undertaken *poste haste* all over India only to find that sugarcane mosaic was present almost all over the country.

Symptoms of disease

The chief symptom of the disease is the mottled appearance of the leaves, particularly of the central spindle, and patches of dark and light green colour alternating with each other. Mottling is most prominent on the first, partly unfolded, leaf of the crown, it is fainter in the comparatively older leaves below, and may hardly be discernible in the very old leaves towards the base. The diminution of mottling in the lower leaves is merely due to the masking of the mosaic symptoms, the juice from such old leaves from mosaic affected plants having been found to contain fairly active virus principle. Mottling also tends to become less distinct later in the season, i.e. November onwards. This variation in the mottling intensity varies greatly with the cane varieties and the season. In certain varieties, for example Co. 213 and Co. 223, there may be almost complete masking of mosaic mottling towards the end of the cane season, while in varieties, including Co. 313 and *Surkha Saharanpuri* the mosaic mottling remains distinct right till the end of the season.

The secondary symptoms, namely, stem canker and stunting of the cane-clumps, are of rare occurrence in India. They have been only once reported from South India. In northern India cane tract no stunting of the cane-clumps of any of the Co. varieties has been observed; only stem markings in the varieties M 16 at Shahjahanpur (United Provinces and *Surkha Saharanpuri* at Karnal (Punjab) have been noticed.

Natural transmission

Spread of mosaic from diseased to healthy plants through natural agencies in northern India is only slight, with the exceptions of a few localities. It is common in southern India. Active natural transmission exists at Coimbatore and various other places in the south, and in northern India at Gorakhpur and Mozaffarnagar in United Provinces; at Gurdaspur, Jullundur and Lyallpur in the Punjab. Natural transmission to a slight extent has been observed at Karnal also. There is practically no natural transmission of mosaic at Pusa (Bihar), Delhi or Shahjahanpur United Provinces. The greatest amount of mosaic transmission is observed during the rainy season or soon after. Natural transmission of mosaic varies from year to year even at the same place, depending on the prevailing weather conditions, which greatly affect the activity of insects.

Although there is ample evidence of active natural transmission of sugarcane mosaic at a few places in India, the insect vector responsible for this natural spread still remains undetermined in this country. Brandes (1923) clearly demonstrated that *Aphis maidis* Fitch is the insect vector of sugarcane mosaic. It has since been proved and recognised universally as the chief insect vector of cane mosaic. Plum aphid (*Hysteroneura setariae*) and the barley aphid (*Toxoptera graminum*) have recently been claimed as minor vectors of the disease.

Aphis maidis is abundantly found in India, both at Delhi and Pusa where no active natural transmission of sugarcane mosaic has been observed as well as at Gorakhpur, Gurdaspur and Muzaffarnagar where active natural transmission of the disease does exist.

Various experiments conducted at Delhi and Pusa during the past few years to effect mosaic transmission with the help of *A. maidis* under controlled conditions have not met with any success. The failure may be ascribed to unfavourable environmental conditions; but Sundararaman and Krishnaswamy working at Coimbatore, a place where active natural transmission is in existence, report that they too have not been successful in transmitting the disease with *A. maidis*.

Curiously enough though *A. maidis* is the chief insect vector of sugarcane mosaic it is seldom found colonising on cane-plant. It is interesting to record, therefore, that *A. maidis* has been found to colonise freely on *shakarchinya*, a thin reed, indigenous cane variety, and to a slight extent on *saretha*, also an indigenous cane.

Recovery of diseased plants

Considering the systemic nature of virus diseases, recovery of a virus affected plant from disease is rather a rare phenomenon. Mosaic affected stock in a vegetatively propagated crop would be expected to give rise to mosaic affected plants; but such is not always the case in sugarcane mosaic, as observed in India. In our tonnage experiments where mosaic and healthy plots were planted with carefully selected diseased and healthy material, it was often observed that the plants in the mosaic plots were not all diseased. Some of the progeny were absolutely normal and healthy looking, without any mosaic mottling.

Leaf juice of these healthy canes (varieties Co. 213, 223, 313, 299 and 419) was frequently tested for latent mosaic virus infection by inoculating young cane, maize and *jowar* plants, but in no case did any mosaic symptoms develop.

Experiments to study this phenomenon were set up at Pusa, Gorakhpur, Shahjahanpur, Muzaffarnagar, Delhi and Karnal, and the results obtained show that the number of healthy plants arising from diseased canes varies with the variety; it also varies from place to place in the same variety and even from year to year.

The progeny of such healthy plants, when inoculated artificially with standard mosaic juice of the respective cane variety developed typical mosaic symptoms readily, showing thereby that these plants are capable of re-infection with mosaic and are not immune to the disease.

Seasonal influence

Considerable seasonal influence on the successful transmission of mosaic has been observed both at Pusa and Delhi. It has been found that the months of May and June

are the best suited when artificial transmission is almost 100 per cent successful and the incubation period is as short as 7 to 10 days. Dry and hot weather seems to help the transmission. Temperature seems to be the most important factor as plants inoculated even in November and incubated in the glazed chambers, maintaining a temperature of 30 to 35°C during the greater part of the day, readily developed typical mosaic symptoms within two weeks and by the end of six weeks 90 per cent of the inoculated plants showed infection; while the plants in the chamber at a temperature of 17 to 22°C developed hardly 10 per cent infection even after 8 weeks. This clearly indicates that the mosaic virus, even during the period most unfavourable for artificial transmission, is as viable as during May and June—the most favourable period of transmission. The failure of artificial transmission is obviously, therefore, due to unfavourable environmental conditions only.

Physical properties of virus

The most interesting finding of the physical properties studies is that the thermal-death-point of mosaic juice of different varieties from different localities showed a very wide range, viz. 45 to 65°C indicating thereby the existence of several strains of sugarcane mosaic virus in India. Three distinct strains are distinguished as represented by Co. 213 (Pusa), Co. 313 (Shahjahanpur) and M 16 with T. D. P. as 45°C, 55°C and 65° C, respectively. These differences in T. D.P. cannot be ascribed to the cane-variety, as Co. 313 (Shahjahanpur) strain after passage through other cane varieties, including Co. 213 (Pusa) and M 16, still showed its T. D. P. as 55°C. They show distinct differences in other physical properties as well, e.g. dilution-end-point, longevity *in vitro*, recovery from mosaic, etc.

Another rather interesting feature is the inability of the sugarcane mosaic virus to filter through either Chamberland (L 3) or Berkfeld (Y) filters. Even the clear amber brown filter paper filtrate is not infectious.

These strains readily cross-infect other cane varieties and have been successfully transmitted to hosts other than cane, e.g. *jowar* (*Antopogon sorghum*), maize (*Zea mays*), *Euchlaena mexicana*, etc. The most interesting cross inoculation result is that of POJ 2878, a cane variety universally recognized as almost immune to mosaic, becoming infected. POJ 2878 has also been found heavily affected with mosaic at Cuttack and Lyallpur.

Another interesting point is that the mosaic pattern is greatly influenced by the cane variety, the same mosaic virus produces very different mosaic pattern on different varieties and thus it cannot safely be used as a criterion for classification of sugarcane mosaic viruses as advocated by some workers.

Seed transmission

Like most virus diseases sugarcane mosaic is not transmissible through true seed. The cane-seed fluff obtained through self-crossing of mosaic affected Co. 313 at Musheri on sowing produced perfectly normal healthy seedlings, free from any mosaic symptoms. Maize seed collected from plants artificially infected with sugarcane mosaic virus (Co. 313) when planted gave rise to normal healthy, mosaic free plants. These have been tested for three successive generations, and the plants remained healthy.

Varietal resistance

The cultivation of resistant varieties, where they are available, is one of the best ways of controlling disease. With this end in view numerous varieties, considered as important and promising, have been under trial for the past four seasons for testing their relative resistance to mosaic. Co. 214 is the only Indian cane-variety that has not been successfully infected with mosaic virus artificially so far. Furthermore, this variety has not been found affected with mosaic naturally at any of the places visited during numerous tours, extending all over the cane tract of India. As a result of our varietal resistance trials of the past four years it may be stated that a great deal of variation in resistance to mosaic is met with in different varieties. Co. 213, 223 299, 312, 313, 331, 360 and 419 have proved highly susceptible to mosaic.

Economic loss

Losses ascribed to the sugarcane mosaic disease by various workers in different countries vary from 5 to 50 per cent, by way of reduced cane-yield and deterioration of the juice resulting in low recovery of sugar. Carefully controlled and properly replicated tonnage experiments conducted for several

years at Pusa with Co. 213, where healthy and mosaic crops were grown in adjacent plots, have shown that even a 100 per cent mosaic affected crop as compared to a healthy one suffered only a reduction of 10 to 12 per cent in the yield of cane, there being no significant difference in the extraction or quality of the juice of mosaic and healthy canes. Similar results were obtained in the tonnage experiments conducted with Co. 213 at Patna and Cawnpore.

Tonnage experiments, conducted in the Punjab at Lyallpur, Jullundur and Gurdaspur by Luthra and Sattar with Co. 223, revealed no significant loss through mosaic disease. Sudararaman arrived at similar conclusions in his tonnage experiments with Co. 213 in Madras.

Recently our tonnage experiments conducted at Shahjahanpur with Co.313 have revealed that like Co.213 the only loss through mosaic consists of about 10 per cent reduction in the cane yield; the quality of the juice remains unimpaired.

On the transfer of the Institute from Pusa to Delhi, tonnage experiments, continued with a thick *ponda* variety, *Surkha Saharanpuri*, at Karnal, have revealed that the loss is greater than with Co. 213 or Co. 313; being 18 to 20 per cent in cane yield. This is in agreement with the results obtained in other countries, i.e. the thick 'noble' canes of Officinarum type suffering comparatively more from mosaic disease. At any rate, the loss even in the case of *Surkha Saharanpuri* consists only in the reduction in cane yield, there being no significant differences in the quality of juice from mosaic and healthy canes.

From the results of these exhaustive experiments, conducted at localities widely distant from one another, it may be safely concluded that the mosaic disease does but little damage under Indian conditions to the Co. cane varieties that are chiefly grown here. Co. varieties even though susceptible to mosaic seem to be highly tolerant to the disease and do not show any appreciable adverse effects by way of reduced yields or deterioration of the juice. These findings thus lay aside the great apprehension that was once felt by the sugar industry in India on account of mosaic disease of sugarcane.

Some of these Co. varieties have found great favour far beyond the shores of India, e.g. Co.281 in Natal (South Africa) and Co. 290 in Louisiana (U.S.A.) because of their indifference to mosaic.

In view of the greater damage caused by mosaic to thick *ponda* canes, as recorded above in the case of *Surkha Saharanpuri* at Karnal the tropical cane tract of India like Madras and Bombay, where thick *ponda* canes are under cultivation, are likely to suffer greater losses through mosaic particularly at places where active natural transmission of the disease exists.

However, it may be pointed out that although the loss through mosaic is only slight yet, considering the fact that there are over four million acres under cane in India, the damage reckoned for 10 per cent mosaic infection, causing one per cent reduction in yield, would amount to Rs 3,300,000 annually assessing the average yield of cane at 250 md. per acre and the price at 0-5-0 per md. The price in force during the current season (1943-44) is as. 12 per maund.

Control measures

Sugarcane mosaic is primarily carried from year to year through diseased setts at places where natural transmission does not exist. The most obvious control measure, therefore, that suggests itself is the use of healthy mosaic-free seed. This can be achieved by obtaining seed from some mosaic free locality or by careful rogueing and selection. The efficacy of the latter has been clearly demonstrated and the disease has been practically eliminated from the entire Pusa Estate cane crop. It has been kept mosaic-free for years by practising careful selection and rogueing. Recently, Co. 313 seed material was selected from such cane crop as showed about 70 to 90 per cent mosaic infection and planted. Observations during the subsequent season showed that out of about 2,050 clumps only 68 showed mosaic infection in May, showing thereby the reduction in mosaic to 3 per cent. These few clumps were rogued out. A second round of rogueing was done in August for any late developing mosaic cases when only eight clumps had to be removed. The remaining crop is being used this season for seed-multiplication purposes and is expected to give rise to mosaic-free crop.

Treating the mosaic affected setts, prior to planting, with hot water (55-60°), or certain chemicals known for their inactivating effect on various viruses, or some of the common fungicides, failed to suppress the mosaic virus.

SKIN DISEASES DUE TO MITES

By B. C. Basu, D.Sc.

Imperial Veterinary Research Institute, Izatnagar

SKIN diseases originate differently; some are external diseases produced by animal or vegetable parasites and others are internal diseases reflected on the skin. In addition to these, there are such affections as granuloma and drug rashes. The subject matter of this note deals with the skin diseases of animals due to an animal parasite, the mite. Mites are minute creatures only just visible to the naked eye. In the adult stage, these invertebrates have four pairs of legs. Nearly all the species lay eggs, from which emerge the six-legged larvæ which moult and become adults with four pairs of legs.

Mites and their infections

Mange or itch mites (sarc ptes): Mange mites burrow into the skin wherein they produce channels and deposit their eggs. They affect human beings, swine, horses, donkeys, mules, camels, cattle, dogs, goats and other animals. Many of them interchange hosts, for instance the mange mites of horses and swine may affect man.

Mange infection due to sarcoptes mite may be successfully treated with ointments or dressings containing sulphur. The composition of one such mixture is as follows: sulphur 2 parts, potassium carbonate one part and lard 8 parts. The hairs on the affected parts should be close-clipped before applying the ointment.

Scab mites (psoroptes): Scab mites are well known as parasites on sheep and also affect other species of animals, including cattle and horses. These mites do not burrow as the mange mites, but live at the base of the hairs of the host, where they pierce the skin and cause an injury which patrially hardens forming scabs. They deposit their eggs on the base of the hair or on the skin.

Scabies of sheep and cattle, the disease caused by these parasites, is best treated with lime-sulphur dips repeated at intervals of eight to ten days. The dip is made in the following proportion: slaked lime 12 lb., powdered sulphur 24 lb., water 100 gallons. The lime is first made into a thin paste by the addition of water. The sulphur is then gradually added and stirred in until the mixture is of the consistency of mortar. Thirty gallons of boiling water is then added, and the mixture is boiled for two hours. The pure liquid is drawn off and sufficient water added to it to make 100 gallons of dip. Before use this mixture should be diluted in the proport on of seven to three. In the case of sheep the damage to the wool is very slight if the dipping is done shortly after shearing.

Follicular mange mites (demodex): Follicular mange is a serious affection of dogs in India. It also affects human beings and other animals. Follicular mange mites inhabit the hair follicles and may penetrate deeply into the skin.

Mange due to this parasite can be effectively treated with a dressing prepared from rotenone, the insecticidal constituent of derris plants. The formula for this dressing is as follows: rotenone 1 gr., alcohol 50 c.c., acetone 10 c.c. water 40 c.c. Rotenone is first dissolved in acetone and the alcohol and water are added. The liquid, which should be shaken before use, is rubbed in vigorously over the affected parts, the application being made daily or at least three times a week, depending on the extent of infection. Odylen (a product of Messrs Bayer and Co.) has also reputed to be a good curative agent. An easily procurable remedy can be made according to the following formula: lard 1 part, sulphur 1 part and phenol one-tenth part. Some workers report good results with ultra-violet radiation.

Other mite infections: Horses, cattle and sheep are affected with chorioptes mange mites. These usually affect the feet, tails and necks of animals. This type of mange may be treated by the repeated application of a mixture of equal parts of kerosine and linseed oil.

Mange in cats is generally confined to the head, face and ears and is caused by notoedres mites. The affected parts are treated with the same sulphur ointment recommended for mange mites.

'Scaly-leg' in fowls is caused by cnemidocoptes mites. It is best treated by dipping the encrusted legs in crude petroleum.

What the Scientists are doing

FOOD PRODUCTION IN INDIA

ON the basis of 1939-40 figures regarding the area under cereal crops in British India, the quantity of cereal foodgrains available for human consumption comes to 53·2 million tons. Average requirements in respect of cereal foodgrains per head per day come to about $1\frac{1}{2}$ lb. But according to the recent census figures, the total quantity of cereal foodgrains required, comes to 57·8 to 67·5 million tons which is higher by 4·6 or 14·3 million tons respectively than what the land can normally be expected to produce under existing systems of crop production. In other words, the present production will have to be raised by 8·6 to 26·8 per cent in order to meet the minimum food requirements of the existing population.

It is thus evident that, leaving aside questions like birth control and other measures for checking the growth of population, our immediate need is to increase food production to the maximum extent possible apart from the economic factors governing crop production. Maximum capacity of soils of different regions or tracts in regard to crop production depends on various factors out of which climate, soil type, soil fertility, quality of the seed and incidence of disease, briefly dealt with below, may be considered to be of outstanding importance.

Although we cannot exercise any control over climate, soil moisture can be controlled to some extent by provision of irrigation facilities and construction of bunds and drains. Comprehensive schemes should therefore be drawn up for the construction of wells, bunds and drains in areas possessing shallow water table and the State should make sufficient funds available at low rates of interest, together with a provision for adequate subsidies and easy instalments for the repayment of loans.

Further, it is essential to see that only such crops as are suitable for particular soil types as well as for soils according to their position factor are grown in various tracts; and special village surveys for this purpose would therefore be necessary.

Indian soils are generally deficient in organic matter and nitrogen, and have now reached a stationary state of fertility at a low yield level, as a result of cultivation over many centuries, without adequate returns of organic matter and phosphate, and due to the lack of proper soil management in certain important directions. Judging from the results of various manurial experiments, it can be stated that application of moderate quantities of nitrogen, i.e., 15 to 20 lb. per acre as farmyard manure, oilcakes or artificial fertilizers raise the yields of common field crops by 25 to 33 per cent. Special efforts must therefore be made to improve the organic matter and nitrogen status of the soils. This can be achieved to a large extent by encouraging the preparation of composts from farm wastes by the cultivators and the preparation of composts from town refuse and night soil in urban areas. As there is a considerable amount of prejudice amongst the cultivators against the use of composts prepared from night soil and town refuse, this material should in the first instance be supplied free and, in addition, small cash payments may also be made to partially cover the expenditure incurred in carting the manure from urban areas to the fields.

With a view to maintaining fertility of soils in general and their nitrogen content in particular, as well as with a view to improving the existing protein—deficient diet of the people, extensive cultivation of leguminous crops by developing suitable crop rotations and mixed cropping practices is urgently required.

Yields of common field crops are in many cases capable of being increased by 10 to 20 per cent if improved varieties of crops are grown in place of the local ones. Efforts should therefore be made to immediately increase seed multiplication centres to meet the demands of the cultivators for improved seeds of various crops.

It is necessary to establish suitable agencies on a regional basis to deal with the diseases of crops, as individual efforts by a few cultivators in this direction do not always meet with success, and elimination of a particular disease

or a pest from the tract as a whole is absolutely essential to save the crop or crops of the locality.

One of the methods suggested at present to increase the production of food crops in India is to break up fallow land. In this connection, the position of the cattle *vis-a-vis* human population must be very closely examined. There is at present a very great scarcity of agricultural cattle in the country and the consumption of milk per capita per day which is already far below the minimum quantity prescribed for a balanced ration, has during recent years further dropped by about 12 per cent. Systems of cropping which are likely to increase the competition between the cultivators and their cattle must therefore be adopted with very great caution and after a full consideration of the pros and cons of this important question.

Taking the modest figure of loss for all crops during storage at 2½ per cent, nearly 1·3 million tons of the stored grain is annually being damaged in India as a result of insect attack. The question of provision of adequate storage facilities to protect the produce against the attack of insects, rats and spoilage due to weather conditions must not therefore be ignored.

In view of the fact that it is obligatory on the part of the State to ensure minimum requirements in respect of food and clothing for every individual citizen, the State must come forward to help the cultivators whenever required. There is no reason why a portion of the increasing industrial and commercial income should not be utilized in giving relief in the form of subsidies to the cultivators, should the business of crop production in comparison with industrial products become uneconomic or unremunerative. It will not be out of place to quote here the examples of stabilization of sugar production in India and England brought about by the establishment of adequate tariff and the grant of subsidies.

Long-range problems relating to food production are : (1) Necessity to conduct properly planned experiments to determine maximum crop production capacity of soils. (2) Need for training a large number of young persons. (3) Colonization of new areas and utilization of demobilised soldiers and various motor vehicles and tanks at present employed for war work. (4) Necessity to stabilize incomes of agricultural labourers and cultivators. (5) Prevention of fragmentation of holdings.

All the forces at our disposal must be harnessed together in order to increase the production of food in India, not only to meet her present requirements but to banish the problem of food deficiency for all times to come.—D. V. Bal, presidential address to the Agricultural Science Section of the Indian Science Congress, January 1944.

What would you like to know ?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and States. This section is reserved for replies to select letters in cases where it seems that the information may be of general interest.

Q. What do the terms Rangeeni and Kusmi lac mean ?

A. *Rangeeni* lac means that it has not been grown on kusum tree or from *kusmi* seed (brood lac). The swarming seasons for *rangeeni* lac are June-July and October-November.

Kusmi lac means that it has been either grown on Kusum tree or from *kusmi* seed (brood lac) on some other kind of tree. The swarming seasons for *kusmi* lac are June-July and January-February.

The swarming seasons given above apply to northern India and not to southern India where climatic conditions are different.

Q. How many crops of lac are there in a year ?

A : There are four crops of lac in a year but the number of crops produced in a particular locality depends on whether it is cultivating both *rangeeni* and *kusmi* lac or only *rangeeni* or only *kusmi*. If in a locality both *rangeeni* and *kusmi* lac are cultivated, it will have four lac crops in a year ; two *rangeeni* crops comprising of *katki* from June-July, and two *kusmi* crops comprising of *Aghani* from June-July to January-February and *Jethwi* from January-February to June-July.

Practically all over India each kind of host tree gives only two crops in a year but in Mysore, Jallari (*Shorea taluka*) trees give three crops in thirteen months.

Q. Can you advise me on the manufacture of milk powder and the sugar of milk ? What is the ratio of each to the weight of milk ?

A. Milk powder is made by two processes namely—Roller and Spray dried. You may please indicate the kind of powder that you want to manufacture so that the necessary description of the method may be supplied by the Director of Dairy Research, Bangalore. Roller powder has a poor solubility and is not useful for reconstituting milk. It is largely used in the ice-cream and baking industry and it serves as a good cattle feed. Spray powder, on the other hand, is practically fully soluble and is best suited for rehydration into milk. In both the processes heat is applied for dehydrating milk in different forms. The equipment is different and methods of operation are not uniform.

The yield of milk powder is between 9 to 11 per cent depending on the quality of milk employed.

Sugar of milk is obtained from whey a by-product of cheese or rennet casein manufacture. The whey is concentrated about ten times in vacuum pans under reduced pressure and it is then heated, precipitants added, diluted, evaporated in the vacuum pan, and then centrifuged to obtain lactose crystals. Finally the crystals are dried at low heat and powdered before sale. The yield of lactose from whey is between 3½ to 4 per cent.

What's doing in All-India

THE PUNJAB

By Ch. Karam Rasul, B.Sc. (Agri.) Associ : I.D.I., P.A.S.

Officiating Associate Professor of Agriculture, Punjab Agricultural College, Lyallpur

THE quarter under review generally remained dry and the low temperature set in rather late this year.

Crop Development

Sugar-cane: Crushing of the crop started comparatively early due to the very high price (about Rs. 18 per md.) of gur (raw sugar), in the beginning of the season. The sugar-factories in the province experienced difficulty in getting sufficient sugar-cane at reasonable price, hence the Government promulgated an ordinance restricting price of sugarcane at 14½ as. per md. of cane. Restrictions were also imposed on the area to be crushed (25 per cent) for the manufacture of gur within the factory-zone.

Cotton: The Desi cotton crop is practically over and pickings of American cotton continues. Normal yields have been obtained in the case of the former while the attack of Jassid and white fly in the earlier stages and continuous dry weather in the later stages delayed the American cotton crop which affected the yield adversely. However, the belated advent of cold weather helped, on the whole, the good opening of cotton bolls and the quality of *kapas* is good. The late crop required being watered late in the season and thus interfering with wheat sowing to some extent.

Rice: According to the second forecast of the crop, the total area under rice in the Punjab is estimated at 1,185,300 acres. The present estimate is 8 per cent more than last year's actual area due to the 'grow more food campaign' and favourable season at the time of sowing. The late sown crop suffered from the attack of rice borer and passed through a period of drought which affected the yield adversely.

Bajra: According to the final forecast, the area under the crop was 3,646,400 acres, showing a decrease of 17 per cent over the corresponding figure of last year. Moreover the season being unfavourable during growth the yield has been badly affected. It was normal in irrigated and below normal in unirrigated tracts. The total production is estimated at 522,500 tons and this indicates a decrease of 27 per cent below that of last year.

Wheat: Sowings in irrigated areas are expected to be about the same as last year but unsatisfactory in barani areas due to the early cessation of monsoons.

Barley: The area under barley is estimated at 781,100 acres (according to first forecast). This is 8 per cent and 17 per cent less than the corresponding forecast and actual area of last year respectively. The decrease is due to the failure of rains at the time of sowing. The weather during October, November and December remained dry. The condition of the crop is normal in irrigated and below normal in unirrigated tracts.

Gram: The rainfall in September was generally below normal except in Montane tracts and in parts of Rohtak and Gurgaon districts where it was above normal. The weather during October, November and December also remained dry. This pulled down the area figures and the target figures aimed at were not achieved. There has thus been a decrease of 19 per cent against the actual area of last year. Rain is badly needed and the prospects of the crop are not very bright. The condition is 79 per cent of the normal.

Rabi oilseeds: The area under *rabi* oilseeds excluding linseed has decreased by 4 per cent as compared with the actual area of the last year and by 17 per cent as compared with the corresponding forecast of the last year. The decrease is attributed to 'grow more food campaign' and insufficient rains at the time of sowing. The present area under linseed is 7 per cent less than it was last year. The weather during the quarter under report was unfavourable for the crop. The condition of the crop is 92 per cent of the normal.

Prices : Taking the Lyallpur market as the basis, the prices of agricultural commodities have shown a downward tendency on the whole due to the rumours of price-control, fixation of the price of cloth and other measures adopted by the Government to prevent inflation of currency.

Locust situation.

Locust continues to be a menace to the province. During the quarter under report locust swarms visited Hissar, Ferozepur and Ludhiana district. Eggs were also laid in some areas. Organisations to cope with this infernal enemy of man, have already been set up on a very firm basis. These were mobilized immediately and the pest destroyed. Crops were saved from damage to an appreciable extent.

Cotton Research Section : At a meeting of the Punjab Provincial Cotton Committee held at Lyallpur on the 15th November, 1943, the question of stopping the growing of Desi Cotton in those areas which are agriculturally and climatically suitable for growing American cotton was considered but as a preliminary step it was recommended that the Department should not stock seed of improved Desi Cotton for the districts of Gujrat, Shahpur, Jhang, Sheikhupura, Lyallpur, Multan and Montgomery. This has been approved by the Government.

Fruit section : The Punjab was not until very recently, considered suitable for viticulture. A trial of about 116 varieties of grapes collected from all over the world at the Experimental Fruit Garden Lyallpur, has dispelled this belief to a considerable extent. Out of these, eight promising varieties have been selected which are doing splendidly as regards their yield and early ripening to catch the market much before the imported grapes become available. However the quality of fruit does not equal that of the Quetta grapes due to shorter growing season and hot dry winds during the time of ripening of the fruit. With a view to improve the quality of grapes experiments on various pruning and training systems as well as different severity of pruning were tried and the results obtained on mature vines are given below :

1. Cane system of pruning gave the best results in regard to yield.
2. Medium pruning i.e., having ten canes each with ten buds, proved to be the best both in regard to yield and quality of fruit.
3. With medium pruning all the fruits became marketable which developed proper colour characteristic of the variety as compared to only 36 per cent marketable fruit produced by unpruned vines.
4. Pruning hastened the maturity of fruit by about a week.
5. The bunches produced by pruned vines were bigger in size than those produced by the unpruned ones.
6. The size of berries was increased by pruning.
7. Sugar contents of the juice of the fruit produced by pruned vines were about 3 per cent higher than those of the control.

Cereal section : The section has evolved a new type (C 217) of wheat for the *barani* area of Rawalpindi Division which grows 40 per cent of the total *barani* wheat which forms 45 per cent of the total wheat acreage grown in the province. It is fully bearded, white hairy, glumed with somewhat, black-awns and amber grains which are distinctly heavier than those of Punjab 14 (the predominant local wheat of Rawalpindi division) and as heavy as those of 8A and C 591 under those conditions. Though pre-eminently suited for *barani* conditions in the Rawalpindi division, and some other places, C 217 has shown itself to be equally good for irrigated conditions.

Entomological section : The N. W. R. administration in the Punjab are storing huge quantities of wheat and it provided an opportunity to make certain important observations regarding the damage done by pest to wheat in the stores and also to try control measures on a large scale. It has been observed that by September wheat had suffered on an average a loss of 1 per cent from the consumption point of view and of 4 per cent from the seed point of view. By the end of December the damage recorded was 2 per cent and 10·8 per cent respectively, showing thereby the tremendous damage which occurs due to defective storage conditions. For control measure on a large scale fumigation with potassium cyanide and commercial Sulphuric-acid proved quite successful. Later researches have shown that Hydrocyanic acid gas is most effective as it

penetrates the gunny bags and destroys the pest in all stages without any deteriorating effect on the grain itself.

Special activities : Schemes are in hand as a war-measure to accelerate the progress of the 'grow more food campaign'.

A scheme for multiplication of seed and increased production of vegetables has been adopted on all Departmental Farms. Some vegetable seeds received from U.S.A. under Lease and Lend Act were distributed among the farmers in important vegetable growing areas.

A scheme of compost making is expected to come into operation shortly. It embodies compost making on a large scale from town refuse and waste so as to make it fit for application to crops. Special trained staff has been entrusted with this work. This scheme is bound to give a great impetus to the growing of vegetables as it will save lot of wastage of manurial ingredients under the present system.

Organisation of Model Farms is a very notable activity of the Punjab Agricultural Department. The owner of a Model farm agrees to take up all recommendations of the Department. It becomes a nucleus for the multiplication of pure seed and a source of education and propaganda for the surrounding villages.

Reclamation of *Thur* land is being extended considerably and hundreds of acres of *Thur* land have been reclaimed on which a good rice crop was raised. In addition, large area of waste land has been broken and put under the rabi crops.

The Punjab Government are contemplating a scheme which will solve the difficulty of the cultivator in the matter of the supply of agricultural implements. The Central Government will supply metal at control rate for the manufacture of expensive implements in Government workshops and private foundries. A portion of the total metal will be allotted to each *tehsil* for supply to cultivators through the head men of the village for the manufacture of hand-tools, etc., and for petty repairs to implements.

POULTRY UNIT AT TALLAKULAM

By Sri K. V. Raghavachari, G.M.V.C.

Superintendent, Livestock Research Station, Hosur Cattle Farm

FOR the purpose of encouraging poultry industry and providing facilities to ryots to grade up the local breed, the Madras Government have opened a number of poultry demonstration units in various veterinary institutions. One such unit was started at the Veterinary Hospital, Tallakulam, Madura district, as early as 7 December, 1940. The unit was started with a nucleus of one leghorn cock and 5 pullets, supplied from the Livestock Research Station, Hosur Cattle Farm. The unit has made a very good progress and without any additional supplies from outside it has grown strong and, after replacement of older birds with young ones hatched out on the station, the present strength is maintained at 12 hens and 2 cocks with 24 chicks of varying ages. Two *desi* hens also are kept for setting purposes.

The details of working of the unit from 7 December 1940, to 30 September 1943 are as follows :

No. of eggs—			
collected	4,040		
sold for table	2,570		
sold for hatching	1,058		
kept for hatching	310		
Broken and fed to chicks	102		
	Rs.	A.	P.
Receipts by sale of birds	321	10	0
Receipt by sale of eggs	271	0	0
Total ..	593	1	0
Expenditure	523	9	8

The existance of the unit has achieved its purpose very well. The working of the unit was not a loss and in spite of increase in the cost of food materials to 200 to 300 per cent over the pre-war prices, and reduction in the sale price of setting eggs from Rs. 3 to Re. 1 per dozen, there has been a profit of nearly

Rs. 70 during the above period. Ryots from the surrounding villages in Madura district visit the unit and are shown round by the Veterinary Assistant Surgeon, in charge of the unit and explained the system of working it. The ryots are also enlightened on the methods of selection, upkeep, housing, feeding, etc. of poultry and advised to take to the industry which would be a profitable one. The unit has become so popular that demands for birds and eggs are received not only from within the district but also from the adjoining district of Ramnad, Tinnevelly, Trichinopoly, etc. Steps are being taken to strengthen the unit by increasing the number of stock to 20 hens and 2 cocks. Luckily, there has been no outbreak of disease in this unit and one of the chief reasons for this is the location of the Veterinary Hospital which is completely isolated from the chances of any infection spreading from the local birds.

Andyur Cattle Show

A ' One day Cattle Show ' was held at Andyur, Bhavani taluka, Coimbatore district on 17 November 1943, under the auspices of the Civil Veterinary Department, Madras and with the cooperation of the local public. The influential ryots of the taluka took great interest in organizing the show and its success was mainly due to their cooperation with the officials. Wide propaganda was done by the distribution of leaflets, etc. about the holding of the cattle show and by the Touring Veterinary Assistant Surgeon of the taluka and some non-official gentlemen also encouraged ryots to bring to the show as many exhibits as possible. The show was arranged in the local shady grounds and the local Panchayat Board had done everything to put up the enclosures, judging rings, etc. to make all sanitary arrangements and to provide adequate water supply. In spite of unexpected rain on the previous evening, about 250 exhibits were taken to the show grounds. The important breed of cattle exhibited was the Kangayam. Bargur breed also was represented by a few bullocks and cows. The other exhibits were a few horses and ponies, rams, goats and fowls. The Government contributed Rs. 150 towards prizes. In addition leading ryots and cattle owners gave generous donations which amounted to over Rs. 1,000. In all there were 17 classes of exhibits and a sum of Rs. 407 was given away as prizes for 64 exhibits. The Director of Veterinary Services and the Livestock Development Officer, Madras, acted as judges. They also spoke to the gathering on matters connected with livestock improvement. The District Forest Officer, Coimbatore, and the District Veterinary Officer, Erode, also acted as judges. The ryots have evinced great interest in the show and have understood the important part such shows play in the Improvement of Livestock.

SIND

By L. M. Hira

Marketing Officer, Sind

THE fifth meeting of the Provincial Board of Agriculture, Sind, was held at Karachi on 11 and 12 February 1944, in the Sind Secretariat under the Chairmanship of Hon'ble Pir Illahie Bakhsh, Minister for Agriculture. The meeting was attended by Hon'ble the Premier, Sir G. H. Hidayatullah, Rai Saheb Gokaldas, Minister for Public Works, Khan Bahadur M. A. Khuro, Revenue Minister, and many other important Government Officials.

Governor's address

His Excellency Sir Hugh Dow, Governor of Sind, opening the deliberations of the Board advised the zamindars to take more interest

in the proper housing and general living conditions of their *haris* and hinted that the Agricultural Department should take a direct and practical interest in this matter by looking after labour of its own farms.

His Excellency referred to the Plan of Economic Development of India, which has issued over the signatures of a few of India's leading industrialists and said, ' Planning is very much in the air now-a-days, and you will not have failed to notice that these gentlemen realize that the full development of India's industrial resources will leave the essentially agricultural character of India's economy unchanged, and they are of opinion that one of the most important conditions of India's future prosperity must be an increase in agricultural production, both by extending the area under cultivation and by improving the yield per acre '.

' I believe this to be true of India as a whole, and I am quite sure that it is true of Sind. The poverty of Sind in mineral resources, about which we know too little, and its climate, about which we know too much, will continue to militate (though not, I hope, altogether successfully) against its industrial development, on the other hand, Sind's potential agricultural development is very great '.

Stressing the importance of the grow more food campaign, His Excellency concluded : ' Government have tried to help by spending largely on the distribution of good seed, by exempting areas sown with foodgrains from lease money and making the maximum supplies of water available from canals. But, the cooperation of every one, both officials and non-officials, in this work is of the biggest importance. It will not only bring profit to Sind, but save many of your countrymen from want and severe starvation '.

The Chairman, in his address, laid great emphasis on the improvement of livestock and described cattle as the backbone of agriculture. He thought that agricultural education among zamindars and *haris* was the most important factor which counted in real agrarian improvement. He added that government had, in the past, provided many facilities to these classes of people but they did not avail themselves of the opportunities afforded to them. He appealed to the zamindars present to make use of the irrigation water provided to them and utilize every inch of cultivable land for production of food so very badly in demand.

Agricultural problems

The Board discussed several problems relating to Agriculture, such as, reclamation of *kalar* lands, settling of agricultural graduates on land, planned agricultural economy, effects of recent floods on soils in the flooded areas, multiplication scheme for vegetable seeds, soil surveys for determining manurial requirement, crop pests and diseases survey, five years plan for development, development of cattle, sheep, goat and poultry-breeding farms, development of milk recording and pedigree stock centres, ghee production, etc.

The Board passed many resolutions and among others, strong recommendation was made to the Government of Sind to impose a ban on the slaughter of milch cattle and buffaloes in the province.

The speed with which the Department of Agriculture is now tackling the problems of the agriculturists was demonstrated when Mr. Roger Thomas withdrew a resolution he had moved, showing great concern at the lack of adequate supplies of iron and steel for agricultural implements, after the explanation given by the Drirector of Agriculture, Mr Isvaran, that his department had already taken up the subject, obtained necessary supplies and made arrangements for distributing 700 pairs of iron tyres and other agricultural implements for the agriculturists through the Inspectors of his department.

Rural reconstruction exhibition

An exhibition was held in Hyderabad, Sind, from 17 November 1943 with a view to furthering the agricultural and industrial activities of the province. The exhibition was a great success, and the unanimous opinion was expressed by a qualified observer : ' the best demonstration yet staged by the Agricultural Department in Sind '.

The exhibition was originally scheduled to run for a week only, but at the request of Sir Hugh Dow, the Governor, it was extended for five days and later on for another 10 days. It is conservatively estimated that during its

28 days run nearly 3 lakhs of people visited the exhibition grounds. Many high officials, members of Legislative Assembly and men and women prominent in public life attended the exhibition. Special days were organised for women, colleges, schools and the services, etc., and these were very well attended. Over Rs. 60,000 were given away in War Fund from gate money and other collections.

Jacobabad horse and cattle show

This annual show was held at Jacobabad from 24 to 27 January 1944, under the Chairmanship of Mr. R. R. Pearse, I.C.S., Deputy Commissioner, Upper Sind Frontier district.

All the classes were well represented and the competition was very keen and the Judges had in many cases great difficulty in selection for making awards. The Upper Sind Frontier District Local Board which organized this show gave away prizes nearly of the value of Rs. 1,500 to various exhibitors.

The All-India Cattle Show Committee also awarded prizes worth nearly Rs. 500.

The best horse in the show was exhibited by Mir Nazir Mohamed Khan son of Kabir Khan and the best Bhagnari bull by the Gowshala (pinjrapole) Jacobabad.

In Class VII, Cows in Milk, the highest yield of milk obtained was 24 lb. per day.

POTATO PRICES IN INDIA

By P. L. Tandon, B.Sc. (Wales)

Marketing Officer, Central Agricultural Marketing Department, Delhi

THE potato crop in India is grown both in hills and in the plains. The crop in the plains is usually grown in the winter under irrigated conditions. The conditions in the Hills widely differ. In northern India, winter is quite severe in the hills and in these parts a summer crop only is raised. In the Nilgiri Hills in southern India, where the winter is mild, a winter crop is also raised in addition to the summer crop.

Harvest time

The harvesting of the winter crop in the plains begins in November and continues up to April. The early sown crop is harvested in November-December, the mild season crop in February-March and the late crop in March to April. The summer crop in the hills of northern India is harvested in August-September. The supplies of hill potatoes start coming into the market from September and continue up till the end of October or the beginning of November. In the Nilgiri Hills in southern India, the summer crop is harvested during August-September and the winter crop in December-January.

Fluctuation periods

During the harvest season, the supplies of potatoes in most markets are in abundance and the prices are, therefore, low. The supplies become scarce with the lapse of time after the harvest, as a result of which prices tend to rise. In northern India, the supplies are lowest during the months of June to November when prices in most markets are at a maximum. The position is, however, different in southern India where prices of Nilgiri potatoes touch the lowest level in August and begin to rise from October or November. The period of maximum supplies in this case is from August to September and prices, therefore, decline during these months.

The difference in prices of potatoes at the harvest time and at the off-seasons is very marked, the off-season price being two to three times the price at the harvest time. In the Cawnpore market, for example, the average price per maund of *desi* variety of potatoes for the five years' period ending 1943-44, ranged from Rs. 2-0-6 to Rs. 5-8-9 during December to March whereas it varied from Rs. 4-8-9 to Rs. 15-3 during June to November. The supplies of hill potatoes during the months of September and October check the rise of prices to some extent in the plains but the quantities are not large enough to have a perceptible stabilising effect on the price level. In order that the price of potatoes in the plains may remain at a reasonable level during the scarcity months, it would appear desirable to extend the area under the late sown crop in the plains

and keep the produce of this crop in a cold store. Potatoes are perishable and in view of high temperature in the plains of India in the summer months, their storage under ordinary conditions is difficult. The facilities for cold storage of potatoes are not quite adequate. The prices naturally tend to decline during the harvest season and are usually high in the off-season. The importance of cold storage cannot be over-emphasised and it is hoped that with the return of normal conditions after the war, the question of providing adequate cold storage facilities for potatoes will engage the attention of the local authorities and the trade interests concerned.

Abnormal prices

As in the case of other agricultural commodities, prices of potatoes in India show a marked improvement since the out-break of the war. The annual average wholesale prices of table potatoes for the period from 1939-40 to 1943-44 for three of the more important markets are given in the table below :

Name of market	Variety	Years				
		1939-40	1940-41	1941-42	1942-43	1943-44
Cawnpore ..	*Desi*	Rs. 2 5 0	Rs. 1 14 0	Rs. 3 3 0	Rs. 6 5 9	Rs. 9 6 0
	Pahari	,, 4 15 3	,, 5 0 0	,, 4 12 3	,, 9 3 3	,, 13 0 3
Patna ..	*Desi*	,, 2 8 3	,, 2 12 0	,, 3 13 9	,, 4 13 9	,, 10 12 9
Calcutta ..	Local Red	,, 1 12 9	,, 1 14 3	,, 2 10 3	,, 3 10 6	,, 7 3 6
	Local Naini Tal ..	,, 2 2 6	,, 2 0 0	,, 3 13 6	,, 6 8 9	,, 13 0 6

Price per maund.

It will be seen that prices in most cases have risen even up to four times the pre-war level. The increase is most marked during 1943-44. In Cawnpore, the average price per maund for *desi* and *pahari* varieties respectively were Rs. 2-5 and Rs. 4-15-3 in 1939-40, Rs. 6-5-9 and Rs. 9-3-3 in 1942-43 and Rs. 9-6 and Rs. 13-0-3 in 1943-44, which was the maximum for the period under review. Similarly, the average price in Patna rose from Rs. 2-8-3 in 1939-40 to Rs. 10-12-9 in 1943-44. In Calcutta, the pices per maund for Local Red and Local Naini Tal varieties in 1939-40 were Rs.1-12-9 and Rs. 2-2-6 respectively. They gradually increased to Rs. 3-10-6 and Rs. 6-8-9 in 1942-43 and reached a maximum of Rs. 7-3-6 and Rs. 13-0-6 in the succeeding year.

Among other factors, the increase in the demand for potatoes owing to the present war conditions is also responsible for the abnormal rise in price level.

MILK RECORDING NEWS

RECORDS for lactations completed during January 1944 have been received from four of the village milk recording centres. The average yield for cows (37) was 2,009 lb. with a maximum of 3,564 lb. yielded by a Hariana cow in the Beri area. The average record for three Murrah buffaloes at Meham was 8,640 with a maximum yield of 10,110 lb. and the average for three local buffaloes in Chata, United Provinces was 3,184 lb. Records for each of the areas are given below.

Hariana cows

Beri area, Rohtak district, Punjab : Seventeen cows completed their lactations in this area averaging 2,871 lb. with a maximum yield of 3,564 lb. and minimum yield of 1,890 lb.

Selected records are given below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield	Maximum daily recorded yield lb.
B.H.25	Bhartu S/o Rupal	3	25-2-43	283	2826	21
D.G.20	Raghbir S/o Balwant	3	10-3-43	260	3139	21
B.H.32	Bachancass S/o Nihala	6	28-2-43	280	3330	23
C.H. 4	Harphool S/o Raju	2	12-2-43	297	2886	17
D.G. 5	Umarsingh S/o Sirichand	4	2-3-43	273	3405	21
D.G. 197	Sirichand S/o Sohan	4	12-3-43	258	3146	19
D.G. 227	Kalu S/o Ram gopal ..	6	4-5-43	210	3255	22
K.M. 337	Bhawani S/o Rampershad	4	1-4-43	300	3564	16
D.R. 5	Snehi S/o Dani	5	26-3-43	294	3528	16

Murrah buffaloes

Meham area, Rohtak district, Punjab: Three buffaloes completed their lactations under record yielding 10,110, 8,622 and 6,990 lb. as shown below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield	Maximum daily recorded yield lb.
M.A.6	Naki S/o Hardiwari	4	20-12-42	390	10110	42
M.A. 123	Badlo Ram Zaildar ..	1	3-11-42	435	8820	38
MA. 28	Chando S/o Jamma ..	3	25-12-42	390	6990	28

Local cattle and buffaloes

Chata area, Muttra district, United Provinces: Seven cows and three buffaloes completed their lacrations during January 1944. The average yield for cows was 1,463 lb. including 1,436 lb. yielded by a grade Hariana cow. The maximum and minimum yields were 2,195 and 1,026 lb. respectively. Out of the three buffaloes one was a Murrah and yielded 3,420 lb. and the other two yielded 3,937 and 2,195 lb. Selected records are as under :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield	Maximum daily recorded yield lb.
163 Buff	Mohanlal ..	3	7-1-43	363	3420	15
225 ,,	Ramfal ..	3	12-12-42	387	3937	18
277 ,,	Mil Suleman	1	1-3-43	306	2195	10
275 Cow	Priya ..	4	1-4-43	276	1436	6
208 ,,	Sukha ..	1	29-3-43	287	1722	8
89 ,,	Manji ..	3	26-1-43	345	2195	9

Travancore cattle

Thirteen cows completed their lactations during January 1944 averaging 1,176 lb. The highest yield was 3,328 and the lowest yield was 472 lb. Selected records are as under. Records for two lactations completed in December 1943 are also given below :

Brand No.	Name of owner	No. of Lactation completed	Date of calving	Date of drying	Milk yield lb.
T.R. 95	Kutty Amma	1	10-4-43	15-1-44	1638
T.R. 199	D. Vareed ..	1	25-2-43	8-1-44	3328
T.R. 250	K. Chellamka	2	21-3-43	10-1-44	1687
T.R. 254	Karthyayani Amma ..	3	20-6-43	15-1-44	1454
T.R. 259	Parukutty Amma ..	3	7-5-44	10-1-44	1520
T.R. 200	K. Janaki Amma	2	3-7-43	18-1-44	1286
T.R. 105	Goverikutty Amma ..	1	26-4-43	15-12-43	796
T.R. 257	Chellamma ..	3	6-6-43	15-12-43	749

Sindhi

Malir area, Karachi, Sind: Records for five lactations completed during December 1943 are now available. The average yield was 3,216 lb. with a maximum of 5,400 and minimum of 2,008 lb. The records are given below :

Name and Brand No.	Name of owner	No. of Lactation completed	Date of calving	Days in milk	Lactation yield	Maximum daily recorded yield lb.
Bodhi 18	Sabu S/o Jiand	..	2-3-43	287	3157	17
Heer 6	Do.	..	4-4-43	254	2540	15
Mahli 20	Do.	..	27-4-43	226	2008	14
Roghi 60	Izat S/o Ahmad	2	25-12-42	360	5400	21
Lakhi 66	Do.	..	20-4-43	229	2977	21.5

IMPROVED DRESSING FOR MILK

IN an article entitled, 'Improved Breeding for Milk Production' appearing in the September issue of *Agriculture*, Dr. Hammond deals with the problems affecting selective breeding for milk production on a broad community basis, with the ultimate object of eliminating inefficient dairy cattle. A widespread movement is urged for breeding more efficient dairy cows to meet the present demands for milk as well as those in post-war period when the shortage of stock and feeding stuffs will be seriously felt. He emphasizes the utmost need for judicious and economical use of feeding stuffs for high-yielding dairy cows, as they are more efficient converters of feeding stuffs into human food than low-yielding ones which use up a greater percentage of their rations for maintenance alone. The average yield of 480 gallons a year of English dairy cows can be raised by means of high-producing diary bulls, which are capable of transmitting with certainty the high milking quality, and upgrading low-yielding cattle with high-producing bulls.

Following the Dutch method of using in succession 'progeny-tested' or 'proven' bulls, whose daughters had averaged a high yield of production, it is possible to breed a large number of efficient bulls. For this purpose while selecting a bull for bull breeding, it is essential to pay to his sires', transmitting capability the same degree of attention as paid to his dams' production.

War Agricultural Executive Committees are seeking the cooperation of breeders of pedigree, 'grading-up', and milk recorded herds for increased registration of well-bred young bulls with a view to their distribution to commercial breeders. In order to prevent large-scale slaughter of valuable young calves not wanted by pedigree breeders arrangements have been made to rear them up to breeding age at the committee's farms or to dispose the week-old male calves to commercial breeders.

For the rapid multiplication of high-class animals and prevention of diseases, pure breeding and upgrading by artificial insemination are recommended. In selecting a pure breed for upgrading non-descript animals careful consideration is required in regard to the suitability of the soil, climate and environment of the holding for a particular breed and the purpose for which the herd is bred.

As regards the low-producing herd of non-descript cows, the author, in view of the scarcity of the livestock in future, is in favour of their preservation and improvement by upgrading rather than fattening and slaughter, although culling and slaughter of old and diseased animals will be necessary. The low-producing non-descript herd can in two generations be made into a herd of quite reasonably good production type by grading up with high-producing pure-bred bulls.—*Agriculture*, September 1943.

SOIL-LESS CULTIVATION

A review of the recent progress in soil-less cultivation has recently been given by Prof. R. H. Stoughton (*Journal of the Ministry of Agriculture*, 49, 25, 1942). In spite of many misconceptions and difficulties, steady progress has been made both in the laboratory and on small scale semi-commercial installations, and a stage appears to have been reached when some reliable judgment can be formed on the question. Two types of systems are in use : (1) in which the plants are grown in a tank of nutrient solution with the roots immersed in a liquid medium. (2) where the permanent sub-stratum is an inert material such as sand or gravel, to which nutrient solution is supplied at intervals. Carefully controlled trials have shown that in general the first of these is unsuitable for use in Great Britain, owing to the difficulty of securing adequate aeration for the roots, and the low light intensity. Far more promising results have been obtained with the second method, which may be considered under two main headings, namely sand and sub-irrigation culture. In sand culture the plants are fed by watering on the nutrient solution from above, the surplus liquid draining away. Tomatoes, chrysanthemums, lettuce and a wide range of vegetables gave very satisfactory crops under these conditions, and promising results have

been obtained with carnations using a slightly modified and simplified technique.

The disadvantages of the system, however, are the care needed in the control of the moisture of the medium, and wastage of materials through drainage, but these are to some extent offset by the small cost of the outlay compared with the sub-irrigation method. In the latter case, the nutrient solution is pumped at intervals from below into the growing tank until the gravel is flooded to the top, the pump is then shut off and the liquid flows back by gravity to the supply tank. The watering and feeding can thus be made almost automatic, the aeration of the medium is excellent and considerable economy in fertilizer materials is effected. Further, chemical sterilization of the gravel is easily carried out. To meet the criticism that soil-less cultivation results in crops of lower nutritional value, chemical analysis of the carbohydrate, protein, inorganic constituents and vitamin C content were carried out. No significant differences could be established between plants grown in gravel and those grown in soil. Experiments are now in progress at the University of Reading, under a grant from the British Electrical and Allied Industries Research Association, to test, among other things, the effect of heating the solution in the sub-irrigation culture of tomatoes. Work is also proceeding on the chemical testing of the solution by simple colour tests, so that its composition may be readily controlled according to the requirements of the crops.—*Nature*, August, 1942.

COLLECTIVE FARMING

IN 'Collective Farming for India' an article contributed by him to *Mysindia 1943 Annual*, Sir Colin Garbet points out that India is already a million tons a year short of foodstuffs and that with the present rate of increase of the country's population, the position will soon become worse. The country's agricultural output must be greatly increased. Only a revolutionary change can achieve this, as measures like the 'grow more food' campaign and improvement of seed varieties can touch only the fringe of the problem. Almost inevitably, Sir Colin looks to Russia for inspiration and collective farming, he thinks, is the remedy. He, however, suggests a modification of the Russian system. The average Indian village is too small to be the unit and, for a model cooperative community, a start must be made with a market town near a railway station. To feed such a town the ideal countryside would be in the region of 50,000 acres. If 2,000 acres are left to the town and its green belt, the remaining 48,000 acres will be divided into 48 estates comprising 12 villages; 1,000 acres to an estate and 4,000 acres to a village. Agriculture will be planned by the village council. Each household would be responsible for the care of a block of land (about 20 acres), and in addition would have an allotment of about an acre for vegetable and garden produce. The Council would decide how much of every crop should be apportioned for consumption, and how much sold for the cooperative fund. To prevent rural and urban populations drifting further away from each other, the model community would be so planned that the identity of interest between the town and the village is emphasized. The town site, for instance, could be made the property of a corporation, and the villages given a dominant interest therein. All unearned increments would benefit the town itself, and all dividends above a reasonable fixed return would come back into the town's business concerns to cheapen water rates, electricity, transport, etc. The cooperative market of the town will dispose of the produce received from the cooperative villages, and the Central Cooperative Bank will finance the village agricultural operations. The implementing of a scheme like this will assure freedom from want and freedom of spirit. The thoughtless critic may say that the Indian villager, apathetic and conservative, will not help himself and that the plan is Utopian. For answer, Sir Colin points to two villages in the Rampur State, in one of which scientific farming of cane has been made a financial success in an area which a few years ago was malarial jungle. In the other village, farming is done on genuine collective principles and fewer acres now provide a better living than the larger farms around it. A detailed examination of the scheme as well as of the possibilities of its early practical application may show that it is much less Utopian than it looks.—*The Capital*, 17 February 1944.

POS-WAR RECONSTRUCTION

CONSIDERATION has been given during the past month to post-war reconstruction of agriculture and trade. The two activities are, of course, inter-dependent since without prosperity in primary production, secondary industries must languish. Effective measures must be prepared for the rehabilitation of the ravaged lands and ruined agricultural industries which the destructive hordes of the Axis Powers have left in their wake, otherwise there will be widespread famine. It is being recognized that the well-being of the farming community is of vital concern to the manufacturer who wishes to find a market for his products from harvesting 'combines' to articles of clothing or adornment. It is appropriate and timely that agricultural scientists of the allied nations should study the best methods of large-scale relief and centrally coordinated reconstruction for putting into operation immediately on the conclusion of peace.

At a special meeting arranged by the British Association, Sir John Russell, Director of the Rothamsted Experimental Station, said that fortunately in agricultural reconstruction the chief factors are known. The peasants will need seeds, animals, food for animals, implements for cultivation, cottages for themselves, and stables and other buildings for the stock. It will be necessary, too, to start educational facilities and introduce methods of marketing at prices that seem fair in relation to the cost of the things the peasant has to buy. An Allied Agricultural Committee has been formed and some of the preliminary work is already in hand. Agricultural experts of each country, who are actually in Britain, are being asked to draw up schedules of the seed required, indicating the crops that should have a high priority—notably fodder. Canada and the United States contain not only as great range of soil and climate as Europe, but also settlers from every one of the occupied countries. It should not be difficult to secure their help in growing seed for their homeland. These and very many other aspects of the subject were dealt with exhaustively at the conference, at the close of which it was decided to appoint a standing committee to advance the application of scientific methods in the reconstruction of European agriculture.—*The Times Trade And Engineering*, April 1942.

CLEAN CROPS FOR SUCCESS

TO be successful in any enterprise it is necessary to apply the most up-to-date methods. A clean field of vegetable corps is like a well managed house where the least amount of dust, moths, and salvage are to be found. Careful management of the soil, disposal of waste materials, use of manure and fertilizer, control of weeds and the protection of the plants against insects and diseases, are all comparable to good house keeping, states T.F. Ritchie, Division of Horticulture, Central Experimental Farm, Ottawa.

Clean fields are an indication of prosperity in the offing and it is much better to have the crops making use of all the plant food and moisture than to have them competing with weeds. Just as soon as the plants are large enough so that the rows can be seen, cultivation should be started, using the wheel hoe close to the rows and the power or horse drawn cultivator where the rows are wide enough. Frequent scuttling will keep the weeds down. Hoeing and thinning should be done promptly so as to encourage the plants to make rapid unchecked growth. Where the plants have been transplanted, cultivation should be given as soon as possible. It is not necessary to give deep cultivation in the fore part of the season. Less injury will be done to the roots where shallow scuttling is given and just as good results will be obtained.

Keep all weeds from going to seed no matter how small they are, as the seeds from these plants will insure a good stand of weeds the next season. Prevention is better than cure.

Be prompt with all disease and insect control measures. Obtain a spray calendar and other publications on vegetable growing from the Publicity and Extension Division, Dominion Department of Agriculture, Ottawa. The materials needed for the disease and insect control work should be on hand for immediate use. The way to be successful in vegetable crop production is to be ready to cope with any emergency.—*Department of Agriculture, Canada.*

New Books and Reviews

THE SOILS THAT SUPPORT US

By Charles E. Kellog (Macmillan and Company, New York, 1941, pp. XI+370, $3·50)

THE author of this book is Chief of the Division of Soil Survey of the United States Department of Agriculture. He is well-known to workers in soil science as the author of numerous publications on soil survey and land utilization. As successor to Marbut he has extended and supplemented the work of that famous scholar. Dr. Kellogg's main interest in recent years has been in the use of soil, a subject which he has enriched with a vast fund of expert knowledge acquired during many years of research at United States experiment stations and extensive travels in and out of America.

The book under review is a popular exposition of the author's philosophy of soil in its relation to human welfare. A comprehensive scientific background is provided by a clear description of the formation and fundamental properties of soil which is followed by an adequate summary of soil classification and the characteristics of various types of soil. The scientific aspects of soil cultivation, the use of soil amendments such as fertilizers and lime, crop adaptation, crop rotation, soil reclamation, and the control of irrigation, drainage, and erosion are then discussed in sufficient detail with emphasis on salient points. These discussions are interspersed with shrewd practical observations which illustrate the author's liberal outlook on the interaction of science and agriculture.

In the treatment of soil formation the author emphasizes the point that weathered rocks are not soil but form the parent material which subsequently develops into soil. The importance of a study of soil on the basis of the pro-file for a proper understanding of crop behaviour, drainage, irrigation and erosion control is pointed out repeatedly. Soil survey and mapping are shown to be indispensable for planning the use of soil. Attention is drawn to the striking consequences of the differences in properties of different soils when adapted to human use. The American Civil War between the grain farming northern settlers and the capitalistic farmers of the South farming with imported slave labour is one instance. The tendency of white poeple to develop large plantations worked by native labour in the tropics is another. The author strongly condemns the method of farming by 'sweated' labour.

In a thought-provoking chapter headed 'Men Use the Soil' the author stresses the necessity for an accurate knowledge of soil characteristics for the successful use of the soil and to serve as a basis for the large adjustments necessary in moving from one type of soil to another. The contributions of science and engineering to improved agriculture in the form of tillage implements, fertilizers, better plants and animals are indicated but the author adds the corollary that mechanization has led to rural unemployment and that the farmer must have capital to take advantage of scientific developments. 'A poverty-ridden people pass their suffering to the soil'.

The disadvantages of continuously growing the same crop on the same land and of the single crop system of agriculture are set out at length. The fallacious notion that a cultivated fallow (mulch) helps to store away the moisture received during one year for the use of the next year's crop is corrected and the advantages of this treatment are stated to be the removal of weeds and the suitability of the rough surface to absorb the early rains of the next season. Deep ploughing and repeated ploughing sometimes advocated and generally practised in western countries are shown to be disadvantageous except in very special circumstances. The common criticism of the shallow and infrequent cultivation of the Indian cultivator as the cause of the poor yields of his soil is apparently untenable.

One of the most interesting chapters in the book for readers in India is on the 'Control of Water on the Soil'. The discussion deals with irrigation, drainage and erosion control. The author points out that 'irrigation stands in striking contrast to the other two techniques. When large dams and other very expensive

engineering works must be constructed to irrigate soils in the desert or semi desert, an entirely new agricultural community must be organized at once where there was essentially nothing before................ . Every person in such a community is very aware, or should be of his dependence upon the others. He can't live by himself. There must be rigid protection and control .... Many old societies dependent upon irrigation were destroyed suddenly when some invader or some revolting faction within the group destroyed the great structures upon which all depended.' Since water in the soil, either too much or too little, can act as the limiting factors of oil productivity, the author lays emphasis on the importance of drainage not only in regions of high rainfall but in irrigated areas as well. The reclamation of the Pontine marshes near Rome by drainage and other treatments is mentioned as an illustration. The dangers of irrigation leading to the concentration of salts in the soil, accentuated in soils of rolling or sloping topography, are pointed out and the correct remedy is indicated to be, apart from drainage, the examination of soil 'by competent scientists who can predict the results of irrigation from a study of water supply, the soil profiles, and the lay-of-the-land'. The causes of soil erosion are adequately discussed and in describing the practical measures adopted in control work the pitfalls involved in a blind adoption of terracing or other devices are pointed out. In the author's view 'the fundamental basis for the control of run-off and erosion must be a vigorous plant cover, which depends in turn, upon the maintenance of soil fertility and structure'.

Dr. Kellogg's book is extremely well-written. It is not a text book in any sense of the term, but in spite of the easy style adopted the statements are rigidly accurate and up to date. There is a wealth of information which the lay reader or the specialist in India could absorb profitably. Administrators and others who control the purse strings of agriculture would derive immense benefit by a careful perusal of this book and may even be persuaded to take direct personal interest in the improvement of Indian agriculture.

Only one misprint was detected (formula of sodium carbonate in line 12, page 127). The table of size limits of soil fractions on page 51 is not in conformity with the present International System although the accepted value is given for clay.

The book is strongly recommended to students and research workers in India.—S. P. A.

MYSINDIA ANNUAL 1943

(Editor: D. N. Hosali, 1-A, South Parade, Bangalore, Rs. 2).

THE publishers of Mysindia deserve to be congratulated for bringing out a successful annual (1943) number of their publication, in the present times of paper difficulty. The articles contained in this annual, being contributions from people competent to write on their respective subjects, are of a high standard and cover a wide range of subjects of topical interest. While problems of post-war reconstruction very naturally form the background of most of the articles published in this number, the variety of subjects dealt with in them provide a thoroughly enjoyable and instructive reading. Rural reconstruction, educational reform, industrial development, economic welfare of the masses, development of air, land and sea transport, town planning and general rehabilitation form themes of some of the articles of the annual under review. Amongst these, 'An Empire Council' by the Rt. Hon. John Curtin, 'The Future of India' by Sir Fredrick E. James, 'Collective Farms for India' by Sir Colin Garbett and 'Post War Air Travel in India' by Air Marshal Sir John Higgins are contributions of special interest. Diversion from the serious yet important problems of life is provided by articles such as 'Who designed the Taj', 'The Shiva Temple at Sandur', 'Some Himalayan Experiences' and 'Chinese Poetry'.

The annual with an attractive cover by Shrimati Shanta and inclusive of a number of pictures and art plates can be said to have an excellent get up.—M. R. D.

From All Quarters

VINE CHILLY

CHILLY, as everybody knows, is one of the main essential food crops. Its price is not easily within the purchasing power of men of ordinary means. Its use in green and dry forms in the daily meals of every man is too well known to be mentioned. It occupies, for eight months in the year (August to March), nearly three lakhs of acres of good and fertile soil of dry and irrigable land in the province. Being an exhaustive crop it is heavily manured. It is highly susceptible to the attack of minute insects calledthrips which c annot be easily overcome and which reduce the yield to a very great extent.

There are several varieties differing in size, shape and taste. Of the various ways and means suggested to increase the produce of foodgrains and other essential crops to meet the present heavy demand on these commodities, one is the introduction of what is called vine chilly. In one of the agricultural tours in the countryside of Mysore bordering Hindupur taluka, I observed in a small arecanut garden about half a dozen plants nearly $4\frac{1}{2}$ years' old and 15 to 20 ft. tall and a good number of others ranging from three months to two years and 2 ft. to 10 ft. high—all in bearing of green and ripe fruits. Besides these plants, I also saw a good number of betel vines being grown. The arecanut trees served as supports to both the vines.

The soil is of a medium light black loam with water table at a depth of about 25 ft. Ever since plantation the half a dozen old chilly vines, not subject to thrip attack so far have been yielding enough fruits green and ripe for a family of about one dozen members of the grower. There are two distinct varieties, one with fruits $\frac{3}{4}$ to 1 in. length and the other with $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. length. Both are highly pungent and the quantity consumed is considerably reduced. Nursery is raised on a high level piece of land and after a month and a half the seedlings are transplanted at a distance of 4 to 6 ft. where 2 ft. × 2 ft. ×2 ft. pits were dug and filled up with good well rotten cattle manure and fertile soil and every year manuring is done. From the fourth month after planting they begin to bear and then no day will pass without having green and ripe fruits.

Many species of ornamental plants are grown as bowers in the compounds of residential quarters and parks; and large is the area under arecanut, betel vine and other partial shade and occasionally irrigated gardens. In all of these the vine chilly can be successfully and usefully grown to meet the increasing demand without encroaching on areas under grain crops. At present seeds will be made available in small quantities specially for seed multiplication for further distribution.—K. V. Seshagiri Rao, Assistant Agricultural Demonstrator, Hindupur.

BRITISH MILK PRODUCTION

NEARLY £90,000,000 was paid to British producers of milk by the Milk Board in the year which ended 31 March last. Milk prices to producers for the next twelve months are to remain the same as last year. The average retail price only rose from 27·50 *d.* to 35·63 *d.*, but this was at the cost of £11,000,000 in subsidies. Licensed producer retailers number 58,115, and there are 125,750 registered producers selling milk by wholesale. Milk production for the year exceeded 1,100,000,000 gallons, 50,000,000 gallons greater than the pre-war average. The public consumed over 1,000,000,000 gallons as liquid milk, which is nearly 300,000,000 gallons above the pre-war average. A recent census showed that 79 per cent of children attending elementary schools in England and Wales receive milk under the Milk in Schools scheme, the percentage for secondary schools being 59·8.—*The Australian Dairy Review*, August 23, 1943.

RAZA RING READY RECKONER

THE following Ring Ready Reckoner has been designed to calculate the time of calving of a cow, if the date of effective service is known.

As a result of over 12 years experience of cattle and dairy farms I felt the necessity of a calculating disc that can give results without actually making calculations and may be a practical help to the farm superintendent or cattle yard superintendent.

I had thought that the 2nd Cattle and Agriculture Show, held at Rampur in 1943, where I was on deputation, would provide a suitable occasion to exhibit such a disc. But, unfortunately, I was not able to prepare it in time for the exhibition. Since the idea was an original and not a borrowed one, it could not be released without its thorough scrutiny.

Now, as to the disc itself. It consists of two main rings each having twelve divisions representing the calendar months of the year, with the four weeks under each month. To be more accurate it could have been divided according to the number of days under each month, but for the practical purposes it is designed so as to give the time in weeks only. The outer ring gives the week in which the cow gets effective service, and the inner ring gives the corresponding week of calving under normal condition.

Example.—Suppose a cow is served and conceived during the 3rd week of December. Looking on the Ready Reckoner one can immediately trace the corresponding week in the inner ring, against the 3rd week of December of the outer ring. In this case it corresponds with the 4th week of September. This shows that the cow will calve during the 4th week of September, this may be verified by calculation as well.

The working of this Ready Reckoner is so simple that it does not require any further explanation. It may be a great help to cattle breeders, and a necessity to cattle farm superintendents. One Raza Ring Ready Reckoner painted on a large-sized board may be placed with advantage at every cattle farm. Such a design with Hindustani months may also be prepared. And I have also prepared a sliding ready reckoner that can be utilized not only for cows but for other animals as well.—Mohammed Taqi Raza, Agricultural College, Cawnpore.

DON'T

Grow crops continuously on the same plot. The soil requires rest and you get better yields after fallowing.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V | MAY 1944 | No. 5

THE UNDERPRIVILEGED IN RURAL AREAS

TWO of the aims in the Atlantic Charter are freedom from Fear and Freedom from Want for all peoples. The priority given to freedom from fear, without which freedom from want cannot be achieved, arises from the fact that nation building will of necessity be hampered and retarded if the national resources of wealth have to be diverted from the development of social services to armaments and other engines of war as a protection from foreign aggression. The leaders of the United Nations are engaged in devising ways and means for ensuring freedom from fear for all nations under post-war conditions. The Allied Nations' Food Conference held at Hot Springs conducted its deliberations on the assumption that freedom from fear would be achieved in good time. Each of the Allied Nations is now actively engaged in preparing plans for nation building on this same assumption.

The measures which must be adopted before freedom from want for all people of all nations can be achieved have been enumerated clearly in the recommendations of the Hot Springs Conference. There is no 'Open Sesame' for the achievement of this aim ; it can materialize only as the result of concerted and coordinated effort by all nations along many fronts. The nations represented were agreed that its realization is within human competence. The report of the Conference provides a framework for all nations to proceed with nation building. It is the underprivileged of all nations who are the chief concern of nation builders. How are these people to find enough food, clothing, and shelter, the three essentials to human existence ? Can full employment be found for all ? Can the children of tomorrow be given equal opportunity of education ? Can the occasional ray of sunshine be brought into their family lives ?

Included amongst the aims of nation builders are such fundamentals as an improvement in the level of nutrition which should not be less than the minimum prescribed by nutritional experts to maintain good health and vigour ; a progressive rise in the standard of living of the poor to enable them to enjoy a modicum of the amenities of life and at the same time, to have enough leisure after the day's work to devote to their social and spiritual needs, and an equal opportunity to all in the battle for life. These aims imply an economy of abundance and full employment for all. Western nations are becoming increasingly conscious of the obligations of the State to find employment for all and to adopt such measures for social security as not only will prevent the aged, the infirm and the unemployed from becoming destitute, but will enable them to enjoy a reasonably full life. Measures adopted to this end include Old Age Pensions, Health Insurance, Unemployment Insurance, etc. In this respect the Beveridge plan in Britain is comprehensive in its scope. What of India ?

It has been estimated that 100 million people out of India's population of 400 million are habitually underfed. The great majority of these underprivileged people live in rural areas. The sources of income of the able-bodied amongst them are either the wages they receive in return for their manual labour or the agricultural produce which they grow. Their earning capacity is limited, therefore, by their effective labour either as wage earners or as primary producers. The effective labour of a small holder or tenant farmer and his family on one-crop monsoon lands is often only a small fraction of his potential labour. In general he has little, if any, alternative avenues for trading his manual labour. The case of the landless labourer who cannot find a tenancy

is still more acute owing to the demand for his labour being strictly limited in rural areas, except at peak seasons on the land. The carting of agricultural produce is customarily an appreciable source of income to the landless labourer and also to the small holder. The modern capitalistic development of industry centralized in urban areas has deprived him of those alternative forms of useful employment in cottage and village industries which were enjoyed by his forefathers.

In general, the underprivileged in rural areas fall into two main classes, namely, small landed proprietors and landless labourers. In irrigated areas the economic condition of these two classes is rarely as acute as on unirrigated areas because of the more intensive two-crop cultivation and the greater opportunity for continuous profitable occupation either as wage earners or as farm tenants. It is in the unirrigated areas which have to rely on the monsoon to raise single season crops on precarious rains that the unemployment of the rural population for long periods each year is most acute. The problem is a grave one. The pressure of population on the land is intense and is steadily increasing. A high proportion of farm holdings is already so small as to be uneconomic to cultivate, and in some tracts sub-division continues unchecked,—and so the evil extends.

Short of measures that may be adopted by the State to ensure social security there is no single remedy in sight for this cankerous economic and social condition of large masses of the people. Yet there are palliatives which, operating collectively, should help to bring sunshine into their lives by offering opportunities for more remunerative employment and better returns for the labour expended. There is scope for raising the level of nutrition and the standard of living of these people by restricting the further sub-division of holdings, by consolidating fragmented holdings, by the extension of irrigation in all forms (be it canals, tube wells, open wells, tanks, or otherwise), by the conservation of the soil and of rain water through extensive anti-erosion measures, by assisting landowners to eradicate deep-rooted weeds with heavy machinery, by the compulsory use of improved varieties of seed, by improving the milk yielding capacity of cows, by so modifying the land tenure and land revenue systems, where need be, as to prevent them from acting as deterrents to production, by the more extensive use of manures and the greater conservation of all organic waste, by the development of cottage industries, by the development of rural power industries to process agricultural products, by the development of basic and other large industries in urban areas, by improving the health of the people and by imparting to them such useful knowledge as will help them to help themselves.

Ignorance is at the root of many of the economic ills of the underprivileged. In India, as in all countries, the part which the State must play in promoting their welfare will thus be large.

RAMAN THOMAS

An Appreciation

RAO Saheb R. Thomas, Assistant Sugarcane Expert at the Imperial Sugarcane Breeding Station, Coimbatore, retired from service on the 23 March 1944. In his retirement, the Coimbatore station has lost one of its most experienced hands and one who, by completely identifying himself with the crop, during the course of his long service had acquired unique ability of selecting the right type of seedling-canes. He practically had no knowledge of the English language, when he joined service. But, through hard work and perseverance, he acquired a working knowledge of the language.

Mr Thomas had been connected with the Sugarcane station ever since its inception and started service at practically the lowest rung of the ladder in the subordinate service. He was a Plant Collector in 1910 and by sheer dint of hard work and ability he rose to the posts of Fieldman, Sub-Assistant and Assistant in 1912, 1916 and 1921 respectively. In 1938 he was promoted to the gazetted post of Assistant Sugarcane Expert which post he occupied with ability till the date of retirement. He received the title of Rao Saheb in the New Year Honours of 1943.

Mr Thomas was a man of simple habits and spent most of his time at the Sugarcane Station on the cane plots. He carries with him in his well-earned retirement, the good wishes of all his colleagues.

Original Articles

ECONOMICS OF CARP CULTURE[1]

By Sunder Lal Hora, D.Sc.
Director of Fisheries, Bengal

In Bavaria, where the farmers grow crops of cereals and of fish, mostly carp, alongside of one another, it is fully realized that the carp ponds are more profitable than an equal area of good land. The details of the economics of carp culture in Europe are furnished by Josef Susta,[2] K. G. Gupta,[3] and F. A. Nicholson[4]. It has been estimated by Nicholson that in Germany the average net profit varies from Rs. 37-8 to Rs. 60 per acre and this is obtained with some certainty and a minimum of trouble. 'The results both in gross out-turn and net profits are considerable; the balance sheets including all charges, cost of manure, etc. show a very useful net profit, which is surprising when the waste and wretched nature of the land is considered' (Nicholson, p. 156). C. B. Hall[5] dealing with commercial aspects and revenue from culture of fish in ponds makes the following observations based on continental experience where carp is highly esteemed: 'One must take into consideration the fact that fish-culture requires less labour than agriculture, less outlay, and is less dependent on the agriculturists' great bugbear, changes of weather.'

'Good carp ponds will produce from 150 to 250 lb. of marketable fish per acre annually. The average prices are: wholesale, 1s. per lb.; retail, 1s. 6d. to 2s. per lb. Live fish command better prices.'

Economics of carp culture

As the carp of tropical countries are usually larger and grow far more quickly than those of European waters, the outturn per acre of available water is usually far greater. We shall now consider some of the recorded cases dealing with the economics of carp culture in India.

Thomas[6] stocked a rain-fed pond of some three to five acres of waterspread at Vallam, in the Tanjore district, with about 2 lb. weight of well selected fry of non-predatory fish at a cost of Rs. 2. The tank had run dry before the rains and was cleared of all predatory fish. A handful of small snails were also put into the tank as food for fishes and fishing was prohibited for 18 months. After this period, the tank was thrown open for fishing with rod and line and it was found that anglers were taking fish out of that pond at a rate which amounted to 4,000 lb. weight of fish a year. 'As time went on, anglers rather grew in numbers than otherwise, and some of them took to it, not as a pastime, but as a profession, selling their takes; and as the fish grew bigger, they started country-made reels and running line, as I taught them, and always met me with a pleased look as I strolled round to ask what sport, and look at their bags; and after more than a year had passed, they declared that not only had all the fishing made no impression on the fish, but the total takes were continuing to increase. As there was no netting, and, only angling, I let them fish all the year round without any close time.'

From these observations, Thomas concluded that 'Two lb. weight of fry yielded, after 18 months, 4,000 lb. weight a year, and in subsequent years yielded at a much greater rate'. He attributes this success to the eradication of predatory fishes from the tank, careful selection of fry and introduction of species that would more or less feed differently. Further, he observed that some Labeos introduced by him in the tank had bred in it with the result that when these fish began to multiply, the total weight of the takes increased very much.

On the basis of the rate of growth of *mrigal* and *catla* observed in a tank in Chinsura and

[1] The object of writing these articles is to invite suggestions and criticism with a view to codifying the existing information for the benefit of pisciculturists in India and for the proper development of the vast inland fishery resources of the country.

[2] *Nourishing of the Carp and his Pond-companions.* Bengal Secretariat Book Depot, Calcutta: 1908.

[3] *Reports on the Results of Enquiry into the Fisheries of Bengal and into Fishery Matters in Europe and America.* Bengal Secretariat Book Depot, Calcutta: 1908.

[4] *Madras Fish Bull.* Vol. xi, pp. 151–160, 1917.

[5] *The Culture of Fish in Ponds.* Bull. No. 12, Ministry of Agric. and Fish., p. 19 (London, 1930).

[6] *Rod in India*, 3rd edition, p. 340 (London 1897).

on the assumption that of the 1,000 fingerlings stocked in a tank not exceeding an acre in extent only 500 survive by the end of the second year, Gupta (*loc. cit.*, p. 33) made the following calculation :

Debit		Credit	
1,000 fry ..	Rs. 15	Value of 750 seers fish at 4 annas a seer ..	Rs. 190
Payment to fishermen for dragging	„ 30		
Miscellaneous ..	„ 5		
Total ..	Rs. 50	..	Rs. 50
		Net profit ..	Rs. 140

Gupta regarded this a low estimate which is often exceeded and observed that: 'If the tank is regularly stocked every year, a clear profit of Rs. 100 to Rs. 200 per annum may be ensured, and that with a minimum expenditure of money or trouble'.

According to Moses[1] 'one acre of suitable water area, it is computed, will easily produce 1000 lb. of fish annually.'

S. B. Setna, Fishery Officer, Bombay, has been conducting experiments on carp culture in sheets of water which dry up annually and have, therefore, to be restocked after being harvested every year. In the Kurla Tank, 4½ acres in extent, he introduced 2,000 carp fry from Patna at a cost of Rs. 28-2 and after 9½ months the fishing rights were auctioned for Rs. 321. This tank was stocked again on 7 July 1942 with 3500 fry at a cost of Rs. 59-12 (Rs. 9-12 for fry *plus* Rs. 50 for transport charges from Patna to Bombay including third class railway fare for an attendant). This tank was auctioned in March 1943 to a party for Rs. 400 who sold the fishing rights to a third party for Rs. 450.

In another tank, Bandra Tank, 1½ acres in area, 3000 carp fry at a cost of about Rs. 50 were introduced in 1940, and in 1941 after a period of six months, 250 *rohu* and *catla* from this tank were liberated into the Ulhas river and the remaining 1600, approximately weighing 1100 lb., were sold at a cost of Rs. 144-12. In the Thana Jail Tank 5 acres in area, 2,000 fry at a total cost of Rs. 38 were stocked and after seven months its fishing rights were auctioned for Rs. 315. Several other tanks showed more or less similar results.

In considering the above data, it must be borne in mind that the fish were taken out after a period of 6 to 9 months, no manuring of the ponds was done before the fish were stocked and no artificial food was given to the fish. The above results should not be calculated on acreage basis as the tanks were not stocked according to their full capacity. Further, on the expenditure side it must be remembered that the fry were obtained from Patna and the cost of their transport to Bombay was fairly heavy. In cases where local supply can be arranged the cost of stocking tanks would be considerably less.

In connection with the above experiments, Setna wrote to say: 'Experience shows that the best results are obtained when the mixed fry contain preponderance of *catla* and *rohu*. These fry grow rapidly and thus yield lucrative returns. The fry obtained from Patna and other centres are mixed and this is the reason why the returns are variable. The fry of *mrigal* and *calbasu*, which sometimes figure very largely in consignments, do not yield satisfactory results. These fish take long to grow and are not profitable from commercial point of view'.

It will thus be seen that the stocking of tanks with selected fry is highly desirable from a commercial standpoint. The success of Thomas's experiment, reported above, was also due very largely to this fact.

As regards rate of growth of fish, Setna has kindly favoured me with the following figures for two tanks. The fry, when introduced, were 1 in. in length.

KURLA TANK

STOCKED ON 7-8-39. FISHED ON 25-5-40.
(9 MONTHS AND 17 DAYS)

	TOTAL LENGTH	STANDARD LENGTH	GIRTH	WEIGHT
Catla	22½ in.	18½ in.	19 in.	8 lb.
Rohu	17½ in.	14½ in.	10¼ in.	2¾ lb.
Mrigal	16 in.	13 in.	8½ in.	1¾ lb.

BANDRA TANK

STOCKED ON 7-8-39. FISHED ON 16-2-40.
(6 MONTHS AND 8 DAYS).

	TOTAL LENGTH	STANDARD LENGTH	GIRTH	WEIGHT
Catla	16 in.	13 in.	13½ in.	3½ lb.
Rohu	13½ in.	11 in.	9¾ in.	1½ lb.
Mrigal	9½ in.	8 in.	7 in.	¾ lb.

From the details given in the above tables, the growth-rate seems to be very satisfactory. In Madras waters a growth of 1 lb. in 70 days is on record (Nicholson, *loc. cit.*, p. 160). In the case of *catla*, Moses (*loc. cit.*, p. 9) has stated that: 'It attains a marketable size in 6 months and a weight of 24 lb. in two years and 40 lb.

[1] *Bull. No.* 1, *Deptt. Fish. Baroda State*, p. 1, 1940.

in three'. Setna's figures clearly indicate the possibilities of such a rapid growth.

Ponds and production

As has been indicated already in earlier articles, the ponds that dry up annually show remarkably good results with regard to growth of fishes. In the annual fisheries of the Bidyadhari Spill area near Calcutta, very good results are obtained through manuring them with diluted sewage. Some of these vast sheets of water are dewatered annually for paddy cultivation, some are dewatered for the improvement of fisheries, but the rapid growth of carp is mainly due to the proper manuring of the tanks. The productivity of the Bidyadhari fisheries is usually 2½ mds. of fish by weight per *bigha* annually. Besides the crop of fishes, in parts of the fishery a crop of paddy is also harvested. In the Abad area of the Sunderbans, where ideal conditions exist for fish growth, catla and rohu are known to attain 6 to 7 seers in weight in one season. It is thus clear that in carp culture very bright prospects lie before an intelligent pisciculturist willing to apply up-to-date scientific methods for the care of the pond and the production of fish crop.

In the case of tanks which do not dry up annually, it is highly desirable not to take out the fish at the end of the first season, for the growth of rohu, catla and mrigal is much more pronounced in the second and third years of their lives. It is stated by De[1] that 'The fishing rent of the tanks (or *khatis*) in the marshes of the *bhil* country in Faridpur, when leased for two years, is three to four times of the rent of the lease for one year'. For fish productivity, therefore, it is necessary to lease out fisheries, whether Government or private, for 5 to 10 years after which the tank should be dried up and its bed properly manured before leasing it out again. The usual term of one year's lease is highly detrimental to pisciculture as the production is one-fourth or so than what it would have been even in a two years' lease.

[1] *Report on the Fisheries of Eastern Bengal and Assam*, p. 72, Shillong (1910).

ANNUAL PASTURES FOR SWINE

GREEN feed in some form is desirable for the health and thrift of pigs of all ages. The growing of annual pasture crops is the simplest, cheapest, and generally the most convenient method of supplying suitable green feed for pigs during spring, summer and fall months.

A mixture of oats and fall rye seeded in early May at the rate of two bushels of oats and one bushel of fall rye per acre has proved the most satisfactory annual pasture crop for pigs at the Dominion Experimental Farm, Indian Head, states W. W. Cram. The oats in this mixture provide green feed from spring until mid-summer while the fall rye will supply pasture from late summer until late fall if not too heavily grazed. Pasture lots may vary from one-quarter acre to one acre in size; a number of small pastures being preferable to one large one. Pigs should be rotated on the pastures as necessary to prevent over-grazing.

Access to pasture is recommended for young growing stock to be kept for breeding and for mature sows and boars. Pigs fed for market, however, will make quicker and more economical gains under closer confinement, provided they are kept clean and comfortable, allowed moderate exercise, and supplied a well balanced ration including green feed. Pasture crops or green feed should be considered as an essential supplement to, rather than a substitute for, feeds ordinarily fed.—*Department of Agriculture, Canada.*

THEILERIASIS IN CALVES

By K. RAGHAVACHARI

Imperial Veterinary Research Institute, Izatnagar

THEILERIASIS in calves is a serious menace to calf-rearing in India. Recently, this disease so seriously affected Grantee Farms in the Punjab that it threatened to put an end to all breeding operations. Every animal became infected, and the mortality ranged from 25 to 30 per cent. Calves recovered from an attack of this disease remain sickly for a considerable period as a result of the derangement of their internal organs, especially of the liver. Theileriasis is a tick-borne disease and the tick suspected here is the 'striped-leg' or 'Bont-leg' tick (*Hyalomma aegyptium*). The infection is handed down from the mother tick to its progeny.

Symptoms of disease

The knowledge of the symptoms of this disease is essential for diagnosing the condition in the field. Consequently, a few of the more obvious symptoms are described below. Calves, when about two weeks old, develop high fever and do not suckle as usual. The superficial glands, especially those in front of the fore and hind limbs, become swollen and prominent. The animals at this period of sickness gradually go off their feed and pass liquid stools, sometimes tinged with blood. In fatal cases, the light-coloured parts of the body, such as the under aspect of the belly and thighs, show yellow pigmentation. The inside of the eyelid is also stained yellow, and there is constant discharge. Finally, the animals abstain from food altogether and die after a day or two.

Preventive measures

Control measures adopted with encouraging results in a Grantee Farm in the Punjab, where infection was very heavy, are described below and may be followed with benefit on other infected farms. These methods may be classified as (a) hygienic, (b) mechanical and, (c) chemical.

Hygienic measures: Select a sufficiently large area about two hundred yards or more, if possible away from the main herd. As theileriasis infection is more acute in the summer months, the selected spot must be shady and cool. Enclose the site with wire fencing and provide around the fence a channel 6 in. wide and 6 in. deep to hold a constant supply of water. Over this enclosed area spread plenty of straw to a depth of about 6 in., covering the entire area and set fire to it, in order to kill all ticks in the area. Then plough the land and repeat the firing operation once or twice to be sure that all ticks are destroyed. This process must be repeated at intervals of a week or ten days. Once the ground is cleansed in this way, further ingress of ticks will be prevented by the surrounding channel of water. Now level the ground and introduce into the enclosure all the new born calves, after examining them to make sure that they are not harbouring any ticks on their body. These operations should be started early in March when the trouble usually starts. During the hot part of the day the calves should be made to stay in the shade of the trees, by providing them, if necessary, with an inner enclosure. For the rest of the day they can be allowed to move about within the outer enclosure. It is desirable to wean all these calves. Where this is not possible, the calves should be allowed to suckle their mothers outside the enclosure and when they have finished their feed, they should be examined for the presence of ticks which may have crept on to them from their mothers, and then only should they be allowed to re-enter their enclosure. This arrangement should be adhered to until the beginning of winter. By this time the first batch of calves will be six to seven months old and at this age they may be allowed in batches to mix with the main herd. Experience has shown that at this age in the cold weather the infection is less severe and the animals are able to combat the disease more successfully. Young calves suffer more than the old ones, and the policy outlined above takes advantage of this fact. On recovery the animal is immune. In addition to the above, efforts should be made simultaneously to get rid of all ticks on the farm. This is more easily said than done. However, a few methods are described below which will, if strictly followed, eradicate ticks or reduce their numbers to a minimum.

Mechanical methods: This is a laborious task

and involves labour and time but well repays the effort involved. All animals must be examined very carefully at least twice a week and any ticks found removed. These should be destroyed by burning or by putting them in a strong lotion of phenyle. The younger generation of ticks (larvae and nymphs) should be removed from the animals by thorough brushing and combing. Particular care should be devoted to the folds of skin, the under aspect of the abdomen, the udder, the elbows and thighs, which are favourite sites for ticks. Cattle byres should also be treated to free them from ticks. A blow lamp, as used by painters for removing old paint, should be used to burn all ticks that may be hiding in cracks and crevices, and where the interstices are too deep to be sterilized, they should be sealed up. The walls should be white-washed with lime. A narrow trough or channel of water placed on to the wall at a height of 3 to 4 ft. from the ground will prevent ticks from crawling to unreachable heights or hiding in the roof.

Chemical methods : Disinfestation of cattle from ticks by chemicals should be carried out under the supervision of a qualified veterinary surgeon, as the chemicals used are poisonous and careless application may lead to serious trouble.

The chemicals may be applied by brush, sponge or spray. Special sprayers for the purpose are available in the market. When applying chemical solutions, particular care should be taken to see that all skin folds are properly wetted, also the lower abdomen and the legs, as otherwise, the nymphs and the larvae which usually hide in these folds escape death. Wetting of the legs and the lower abdomen will hinder ticks crawling upwards. Where there is a large number of cattle to deal with, recourse should be made to the dipping method of treatment. This process again should be carried out under veterinary supervision. Cattle should be fed, watered and rested properly before dipping. After treatment, they should not be exposed to the heat of the sun, as otherwise their skins become inflamed. Cattle should be dipped only on a warm day. These chemical methods of treatment are intended to kill all the attached ticks *in situ*. These should be brushed off when the animals are dry. A few may escape death, but these are damaged to such an extent that they can no longer multiply. It is a good practice in the tropics to dip all cattle and calves at intervals of a week or ten days from the beginning of summer to the end of September.

Pastures

In addition to the treatment of animals as described above, attention should be paid to pasture lands. It is well-known that animals, cleaned of all ticks when sent out to graze, return home for the night heavily re-infested. The pasture land is the source of this trouble. For this reason these lands should also be disinfected as follows : All stumps and dry grass should be burnt at the end of the grazing season and the land thereafter well ploughed and irrigated. According to some foreign workers, the growing of clover and lucerne will clean such lands of ticks. In farms where large pastures are available, cattle should not be allowed to graze in localities known to be infested with ticks. Rotation of pastures and rational treatment of the soil should be undertaken. When an interval of 12 to 15 months is allowed between the use of such lands for cattle grazing, all ticks will die off during the interval on account of the absence of the specific host. Such pastures can be used for the grazing of other species of animals, such as sheep or goats. Moreover, since poultry feed on cattle ticks, they may advantageously be used to free cattle farms from ticks.

INDUSTRIALIZATION OF AGRICULTURE[1]

By Kartar Singh, B.Sc.(Ag.), N.D.D.
Assistant Director of Agriculture, Punjab

THERE has often been a controversy in India as to the relative importance of agriculture and industry. One school of thought holds that India is essentially an agricultural country because 86 per cent of its population is rural and depends, directly or indirectly, on agriculture. In its view the best method of increasing the purchasing power of the country is to improve agriculture. In the opinion of the opposite school industry is far more profitable than agriculture, in terms of labour and capital. In support it is stated that Japan, the United Kingdom, Germany and the United States of America which are industrially highly developed countries have a much higher standard of living than China and India which are mainly agricultural countries, but backward in industrial developments. Further, it is held that industrial development also means more efficient military power and, therefore, industrial countries are better able to wage a modern war both for offensive and defensive purposes.

Industrialization of agriculture

It appears, however, that neither of these two extreme views is sound and that the best course for India is to maintain a proper balance by developing both agriculture and industry on parallel lines. Such a course will automatically end the economic wastage involved in exporting raw agricultural products and importing manufactured goods. The object of this note is to show how agriculture and industry have been developed side by side at Walchandnagar.

Kalamb of old

About a decade ago Kalamb was a small village in Indapur taluka of Sholapur district (Bombay province). According to the 1931 census its population was 1960. The nearest railway station on one side is Baramati at a distance of 20 miles and on the other Diksal (G. I. P. Railway) 40 miles away. It is situated in a rocky tract which possesses few trees and scanty undergrowth. Though the soil of the plateau is black, it is neither retentive nor very deep, except along the banks of the Nira river which flows near the village and divides the Indapur taluka from Malshiras taluka. The depth of the soil varies from 8 to 30 in. and the lower layers are hard *murum*. The soil is impregnated with excessive amounts of salts as indicated by extensive *kalar* patches. Until the beginning of the present century, when an irrigation project was completed in Indapur taluka and about 1930 in the case of Malshiras, there was a great dearth of even drinking water as subsoil water cannot be reached within practicable limits of depth. The average rainfall is about 21 in. of which about 5 in. are received in June, 10 in. in September and the remainder in winter. Before the completion of the canals the tract was subject to famine owing to inadequate or unseasonable rainfall and Government had to advance large sums as *takkavi* loans. Land revenue remissions were also considerable and frequent.

As is generally the case in other parts of India, holdings were small and fragmented. Out of a total of 2,900 owners in nine villages, including Kalamb, 67 per cent owned less than 12 acres each, 23 per cent between 12 and 30 acres each and only 10 per cent owned more than 30 acres each.

The crops grown were predominantly food-grains. *Jowar*, mainly *rabi*, represented 70 per cent, safflower as a cover for the *jowar* crop 11 per cent and *bajra* 9 per cent. Cotton and groundnut were also grown to some extent ; sheep rearing was practised in some villages.

The price of dry rainfed land was Rs. 20 per acre and of canal irrigated land Rs. 75 per acre. The annual rent of irrigated land was Rs. 6 per acre before the war and the assessment was Re. 1-4 per acre. The average daily wage in 1921-31 was Re. 0-8-6. In 1939 it came down to As. 4 per day.

The Kalamb village thus had all the drawbacks inherent in an Indian village, small and fragmented holdings, shallow unretentive soil

[1] The facts given in this note were collected during the fourth session of the Indian Society of Agricultural Economics which met at Walchandnagar during December 1943.

impregnated with excessive salts, isolation from rail and post office, no educational and medical facilities. Today all these drawbacks have ceased to exist and this small unknown village has been transformed into the flourishing garden town of Walchandnagar, through the vision of the well-known industrial magnate, Seth Walchand Hirachand.

Centre of agricultural industry

With the imposition of a protective duty on sugar by the Government of India in 1932, Messrs Marsland Price and Co., an engineering concern, decided to undertake sugarcane farming and sugar manufacture. It started in 1933-34 with an initial capital of Rs. 6 lakhs and a block capital of 13·4 lakhs and selected Kalamb as the centre of operations. Initially all the land was taken on a 30 years' lease. In 1933 the area under cultivation was only 1,400 acres. The crushing capacity of the first sugar factory erected that year was only 150 tons per day ; it crushed about 9,000 tons of cane in 83 working days and obtained a sugar recovery of 8·67 per cent. The quantity of sugar bagged was only about 798 tons.

New means employed

In developing the estate the management first gave attention to the reclamation of the salt affected waste land, so as to make it fit for cultivation by means of canal irrigation. This was done by opening 16 miles of drains with four miles of underground pipe line.

The second step was to open up and bring under cultivation, by means of mechanical power, the hard *murum* soils, till then abandoned by previous holders as barren land. Today the estate uses 10 tractors—nine of 80 B.H.P., and one of 40 B.H.P., with the necessary quota of tractor-drawn implements, such as mould board plows, disc plows, cultivators, levellers and ridgers.

Next came the development of transport and communications. The whole area of this estate is spread over 45 sq. miles and it was very necessary to connect the factory with the most distant field. To meet this internal demand a tramline was laid down. Its total length is about 65 miles and the gauge is 2½ ft. This provision has made it possible to bring 1,200 tons of cane daily to the factory and to take 100 tons of sugar from the factory to the railway station at Diksal. In addition, 20,000 tons of oilcakes, oils and miscellaneous articles are carried by the tramline annually. The estate has its own railway siding with godowns in which to store produce and goods for ready delivery. In constructing the tramline two major bridges had to be erected : one having 15 spans of 40 ft. each crosses the Nira river, the other with 15 spans of 30 ft. each crosses a *nala*. A small hill has also to be cut through.

A fleet of motor lorries is also employed for transporting materials required at the factory. A bus service works regularly *via* Baramati to Nira railway station — a distance of 45 miles. Another bus service covers the 40 miles to Diksal. For these purposes the Company maintains 5 cars and 23 lorries and buses.

A regular telephone service operating over a total length of 40 miles is installed on the estate. It connects the main office with all the six agricultural stations. A second telephone line connecting Walchandnagar with Diksal railway station enables efficient working of the railway line. A third automatic exchange connects all the factories, main office and residences of all chief officers. For the efficient running of the mechanical transport and other installations a large up-to-date mechanical workshop with qualified staff attends to all repairs immediately.

Qualified staff

These many developments have necessitated the employment of a large qualified staff and the investment of considerable capital. That this has not been grudged is shown by the fact that the initial capital and the block capital were increased to 13·5 and 70 lakhs respectively in 1942. The higher staff now consists of 18 qualified agriculturists, 10 engineers and 10 chemists. The area under cultivation has increased from 1,400 acres in 1933-34 to about 11,000 acres and the area under sugarcane increased from 1,050 acres to 3,500 acres in 1941-42. Further, the crushing capacity of the sugar factory was increased to 450 tons in 1935-36, 600 tons in 1937-38 and 1,200 in 1939-40. The total population of the estate has increased to 8,000.

Walchandnagar now possesses an area of 17,113 acres, of which 3,413 acres were purchased through private negotiations only, the offer for requisitioning land by Government having been turned down. About 13,700 acres have been taken on lease from various small owners on an yearly rent of Rs. 74,966, i.e. Rs. 6 per acre.

Sugarcane cultivation

As sugarcane is the pivot round which the whole industrial enterprise of Walchandnagar revolves, it will be of interest to describe the cultivation of this crop in some detail.

The climate is mild and there are no extremes of temperature such as are found in northern India. The sowing period of sugarcane extends from July to October. The growing period of the crop is about 18 months. About 1,400 acres are sown in July. The cane from this area is available for the factory from December to March. About 350 acres are planted in October-November. This crop is ready in March-April. The balance of 1,750 acres which is ratoon from the previous year's crop is available for crushing from October to December. Sugarcane is planted in ditches 3½ ft. apart. Earthing up and weeding are done twice. One thousand acres are grown every year under sunn-hemp for green manuring. This is sown in June and buried in August. About 100 acres are manured with farmyard manure. In addition to these bulky natural manures, ammonium sulphate at the rate of 4 cwt. per acre and groundnut cake at 1½ tons per acre are also added. Owing to shortages of ammonium sulphate, it has been replaced by an additional 1½ tons of groundnut thus making a complete dose of 3 tons of groundnut cake per acre. The cake is applied in three doses to ratoon cane and in four doses to planted cane. The first dose is applied one month after planting and the remaining doses are added at intervals of about 1½ month each. The ratoon crop gets only 2 tons of cake, while planted cane gets 3 tons per acre. July planted cane receives 45 waterings, but for late planted cane and ratoon canes 42 waterings are sufficient. All cultivation work is done by means of tractors. There are only 180 pairs of bullocks on the estate and they are used for carting cane from the field to the tramline or for doing odd jobs. Two varieties of cane are grown: P.O.J. 2878 for early and Co.419 for late maturity. The improvement derived from the application of up-to-date scientific agricultural methods in the form of (a) thorough cultivation by means of mechanical power, (b) planting cane in ditches and then earthing it up, (c) sowing improved varieties P.O.J. 2878 and Co.419, (d) using manures, etc. is reflected in the increased yields of cane per acre and the higher sugar recovery. In 1933-34 when the Company started its work the average yield of cane per acre was only 30 tons: in 1939-40 it was 66 tons per acre. Incidentally it may be mentioned that the record yield of 104·5 tons per acre has been obtained from one field whilst a single cane measuring 12 ft. long, 7½ in. in girth and weighing 10 lb. has been harvested on this estate. These figures may perhaps constitute a record for cane production in India. Similarly, the sugar recovery which was only about 9 per cent during the first three years rose to a little over 11 per cent in the next four years. Workers get As. 12 a day as against As. 8 a day in the adjacent areas. The cost of cane cultivation per acre is calculated as follows:

Preparatory tillage	Rs.	25
Cane sets for planting	,,	25
Cost of planting	,,	5
2 intercultures, weeding and earthing up	,,	18
Manuring, 2 tons cake at Rs. 60 per ton	,,	120
Watering charges	,,	70
Application of water	,,	22
Stripping at As. 8 per ton	,,	23
Carting from field to tram line	,,	23
Carting to factory	,,	18
Rent of land	,,	6
Supervision	,,	30
Total	Rs.	385 (say 400)

Taking the average yield of cane to be 46 tons the cost of cultivation per maund of cane amounts to about As. 5. These are pre-war figures, the present costs are about twice as high.

Useful by-products

As sugarcane requires heavy manuring and as the soil responds well to organic manures, the estate decided to produce its own cake. Its annual requirements are over 100,000 bags. An oil mill was, therefore, erected in 1938. To utilize the raw groundnut oil to advantage a refining and vegetable ghee plant was put up. A soap section was added to utilize the waste products. This required large quantity of caustic soda which was not easily available, but the factory prepared its own requirements by causticizing washing soda with lime.

The disposal of molasses presented the next problem, which was overcome by erecting a distillery to manufacture rectified spirit. Fifteen hundred pounds of spirit of 97 per cent purity are produced daily. The spent wash of the distillery is used for irrigating and manuring the land.

Sugarcane tops provided another by-product. To use them profitably a dairy was started. It consists of 350 milch animals with calves

and bulls. On an average about 1,500 lb. of milk are produced daily. After meeting the estate requirements, the surplus is sent to Poona. As the distance is long, a pasteurizing plant with a capacity of 400 lb. milk per hour was put up. It is proposed to increase the dairy herd to 2,000 animals.

Fuel requirements of the sugar factory are met from Bagasse. The trash, i.e. dry leaves of cane which represent about 12 to 15 per cent of the total weight of cane is manufactured into paper and cardboard.

Experiments are also being made on the dehydration of vegetables. One thousand acres of vegetables are also grown on the estate for supply to the army.

It will thus be seen that the aim of the Company is to utilize by-products of all kinds to the fullest extent possible and to produce the material needed in their manufacture. It may be added that the oil refinery, the vegetable ghee plant, the distillery plant and the machinery have all been designed and manufactured in the Company's workshop in Bombay by Indian labour, Indian imagination and Indian management and have given satisfactory results. As the canal water supply for irrigation was inadequate it was decided to lift water by erecting a pumping station on the Nira river. The engines used are 100 B. H. P. internal combustion diesel — the only type so far made in India by Indian labour and Indian management. The height of the lift from the river bed is 55 ft.

New ideas bring prosperity

It will be clear from this narrative that on this estate there is not only a marriage between agriculture and industry but there is also a marriage within agriculture itself between crop growing and animal husbandry. The development of this estate on these lines has resulted in a definite increase in the wealth and prosperity of the local inhabitants, and such a method of increasing national wealth under similar agricultural conditions can be commended to those who possess the necessary capital, organization, ability and skill.

THE GREAT PROBLEM

'I CANNOT too strongly emphasize the fact that, next to the farmer's own ability, the soils of Canada will continue to govern the food production. Legislation and conferences will not do it. Conservation of soil, rehabilitation of soil run down or out of kilter, and adequate and economical fertilization of soils constitute the one great problem that is going to determine the volume of food production, its quality, stability of production on which consumers may depend and export markets be developed, and the whole field of animal, poultry, and crop processing'.—*Dr. E. S. Archibald, Director, Dominion Experimental Farm Service, Canada on food production.*

CANNING CHICKEN

By

A. J. Macdonald

T. S. Krishnan and Mohd. Athar Ali

Poultry Research Section, Imperial Veterinary Research Institute, Izatnagar

By inventing a method of preserving foods by sealing them hermetically in containers under sterile condition, Nicholas Appert not only won the prize offered by Napoleon but also laid the foundation of the canning industry. Though serious commercial exploitation of the process did not begin till about the end of the 19th century, subsequent progress was rapid and in 1935 it was estimated that the major producing countries packed a total of 14,442,000,000 lb. of various foodstuffs. Canning enables one to enjoy what are normally local and seasonal delicacies in any place and at any season. Moreover, surplus seasonal foods can conveniently be preserved for future use. In times of war, famine or other emergency canned foods are of special value. For instance, during the present war, in such widely divergent localities as the inhospitable, sun-baked, waterless deserts of Africa; the bleak, blizzard-swept steppes of Russia and the thick, impenetrable, tropical jungles of the Pacific Islands, often hundreds of miles away from the nearest convenient supply base, the provision of the necessary foodstuffs to the fighting personnel would be very difficult indeed, were it not for tinned foods, which thus prove of inestimable value. They enable the supply of properly prepared rations, well balanced, adequate and appetising, compact and easy to handle, simple to store and ready for use.

Poultry as foodstuff

There has always been need to balance the poor average Indian diet with first class protein-rich foods, such as milk and eggs, but the matter has become more urgent and important at the present time owing to the prevalence of total war and of a famine of exceptional severity. Eggs and poultry meat are first class foods which can be produced on a large scale in a short time and comparatively with less effort than milk. Furthermore, the war has greatly stimulated consumption and there is a serious shortage of supplies of eggs and meat. In order to meet these demands there is great necessity for expanding poultry stocks. For commercial egg production females only are required. However, until sexing at day-old is widely practised, it is inevitable that about an equal number of males will also have to be reared until such time as the sexes can be easily determined. As only a relatively small number of males are required for breeding purposes, the producer must either slaughter the surplus males at sexing or market them for meat. Unless the surplus males are properly utilized the cost of egg production is necessarily considerably increased.

The best quality poultry meat is derived from young birds. In America and England large numbers of birds weighing about 1 to 1½ lb. are marketed as a special delicacy. However, in most countries the majority of the surplus birds are sold at a later stage. In India surplus males are often kept over long. The most economic returns are obtained from birds marketed at about 4 to 5 months of age. Males kept longer than five months of age rapidly lose quality, the flesh becoming stringy and dry. Even under the best of farming conditions, however, a certain number of birds, mainly females, have to be maintained for egg production and these are sold for table purposes when unprofitable. Under ordinary methods of cooking surplus, older fowls are not very palatable but they are considerably improved in quality during the process of canning.

Frozen poultry

Practically all the poultry consumed in India are purchased alive and cooked immediately after killing. The trade in live poultry suffers from several handicaps among which some of the more important ones are the difficulty of transportation over long distances, the lack of necessary transport facilities during times of war, the risk of disease infection in transit, shrinkage as a result of long journeys and the difficulty of holding them in the market for any length of time. In many of the European and American countries, particularly in the

U.S.A., a large fraction of the poultry consumed is purchased as dressed carcasses. During periods of glut, when all birds brought to the market cannot be immediately disposed of at a reasonable price, the surplus birds are killed, the feathers removed and the carcasses frozen and kept in this condition to be marketed later when conditions become more favourable. Quick frozen carcasses, carefully packed and properly stored, keep in excellent condition for several years. Preservation in this manner, however, is costly and requires elaborate equipment and considerable technical skill. Unless the volume of material handled is very large, the period of storage sufficiently prolonged and the inevitable additional charges capable of being easily met by the average purchaser, the process is not economic. Conditions in India during normal peace times are not favourable for the marketing of frozen poultry. Even marketing them as dressed carcasses is extremely difficult since the temperatures in the plains during many months of the year are so high that carcasses start to putrefy when kept over-night at room temperatures. The necessary refrigeration facilities for storage as well as transportation, so essential for the marketing of this form of poultry meat, are unobtainable in most parts of this country. Hence, till such facilities are available, only live birds can be marketed.

Chicken canning

There is, however, one form of preserving chicken meat, which seems to promise success and which, at the same time, is not beset with many of the above-mentioned difficulties. This is canning. Canning can be organized on a small cottage scale or on big factory lines and both can be run successfully. The canning plant should be placed in a locality where there is a large-scale poultry industry. Under these conditions the transportation of live birds over long distances, with its numerous attendant troubles and risks, is avoided. Another advantage in canning is that the meat does not require special storage facilities. With reasonable care it lasts in excellent condition for years even when stored under room conditions. Further, the meat can be served for the table in whatever way desired.

Strict hygienic conditions are essential in the preparation of the pack. Since meat is non-acid in nature and is usually canned without the aid of brine, syrup and other preserving material, the complete and effective destruction of all the bacteria and their spores in the can is of fundamental importance. Only a perfectly sterile product can be stored without undergoing decomposition. Since the destruction of many bacterial spores is extremely difficult without employing temperatures higher than that of boiling water, modern methods require pressure sterilization as a standard procedure for the canning of meat and meat products. Cooking under pressure in steam in a closed container also helps to conserve the full flavour of the meat. In chicken canning, as in all other types of canning, attention must be paid to the high quality of the raw material, the proper pre-treatment of the carcasses before being packed, as well as the packing, sealing, processing, cooling and storage of the cans. No amount of attention paid to other factors can make bad meat good. Good quality birds must be selected to get a really first class product.

Tendering of meat

The starving, killing, dressing, chilling, drawing and other processes which are necessary before the meat can be got ready for packing into cans are usually carried out as follows : The selected birds are confined and starved for about 16 to 20 hours and given water to drink. They are then killed by dislocation of the neck, sticking, cutting off the head or other means to ensure free, easy and complete bleeding as well as easy feather release. They are then dressed, i.e. plucked and hung up in a cold room till the animal heat escapes completely. As soon as death ensues the autolytic enzymes of the body start functioning, causing a partial breakdown of the flesh. Hanging, which results in the improvement of the texture of the meat, is called tendering. If, however, the action of these enzymes as well as the bacteria, which are also active at the high temperature of the carcass soon after death, are allowed to proceed unchecked, they lead to extensive breakdown of the tissues and other undesirable changes of a putrefactive nature. To avoid these, care must be taken to allow the animal heat to escape as rapidly as possible by hanging the carcass in a cold room immediately after killing. In modern commercial plants the carcasses are hung in rooms maintained at a temperature of 34–36°F for about 24 hours. During this period the flesh is also properly tendered.

If, as is usually practised in India, the freshly killed carcass is cooked forthwith, without any

tendering, the meat is likely to remain tough even after cooking. This is mainly due to the fact that soon after death *rigor mortis* sets in, i.e. the muscles become rigid. This rigidity only diminishes slowly on prolonged cooking. Hence, unless cooking is delayed at least till the rigor passes off, the texture of the meat is far from tender. Hanging, therefore, ensures the passing off of rigor and the softening of the muscle fibres.

Though hanging in a chilling chamber at 34°F for 24 hours would be ideal, such facilities are seldom available in this country. Hence experiments were conducted to fix the time required to enable the passing off of rigor and the attainment of the requisite degree of tendering under ordinary atmospheric conditions. Under temperature conditions, usually present during the winter months in northern India, the carcasses can be hung for about 24 hours without undergoing putrefaction. During the hot weather, however, when the room temperature ranges round 95 to 100°F the time of hanging is considerably reduced and the meat is tendered in 6 to 8 hours. Hanging for more than 8 hours under these conditions results in green carcasses ; the area and the intensity of discolouration increasing with increased time of exposure. When allowed to hang overnight, putrefaction sets in and the carcass emits a foul odour. Under intermediate temperature conditions the hanging period has to be adjusted to get the desired results. As a general approximation it may be said that cooking should be delayed at least till *rigor mortis* has passed off. This tendering of the meat is one of the most important and essential processes in canning poultry meat.

The further treatment of the carcass is similar to that employed in ordinary cooking. It is first singed and then the head cut off and the blood removed. The shanks and feet, the third joint of the wings, the oil sac and the neck are also cut off. The carcass is then drawn, i.e. the intestines, lungs, heart, liver and the other internal organs removed. The subsequent treatment depends on the type of pack desired.

Canning processes

Chicken meat is generally canned in three ways, viz. (a) whole chicken, (b) disjointed or cut up chicken, and (c) boned chicken, i.e. meat only. Of these, from the commercial standpoint, the first is the most popular pack in normal times. In the second the same type of material is used but the meat is cut up into joints and packed tightly, thereby packing more material into the same space. The last type is usually only adopted in home canning. In this type of pack the birds used are generally much older than those employed for the former two classes. As has been stated earlier, even the flesh of older birds gives much better results when canned than when subjected to prolonged cooking in the ordinary way. In times of war, as at present, this is the form mostly in demand as conservation of space is of primary importance on account of limited transport facilities. With this form of packing there is no wastage in the form of bones, etc. from the contents and maximum utilization of space is made. A brief description of the methods of preparation of the three types of packs is given below.

Whole chicken : The most suitable type of birds for this kind of pack is young chickens weighing about 3 lb. The birds have to be properly killed and bled, carefully picked and cleanly drawn to give the desired appearance. A badly torn skin, the incomplete removal of the pin feathers or a gaping wide hole through which the viscera were drawn all seriously detract from the finish. The drawn carcass, prepared as described above, is carefully packed into a suitable sized can. A 3 lb. bird can be packed into a No. 3 can. Since the meat packed in this manner is cooked during the canning process and as it does not fill up the entire space there is risk of its falling apart, when subjected to the inevitable rough handling of marketing. To avoid this, the empty space in the can is filled with a suitable material, which sets to a jelly when cooled after the canning operations ; this serves to fix the meat and preserve its shape till opened for consumption. The jellying material, being a liquid at the cooking temperature, also enables the rapid transmission of heat to all points of the pack. A 1 to 2 per cent solution of agar has been found to be very satisfactory for this purpose. The jellying material is added to within ¼ to ½ in. of the top of the can whereafter the whole pack is steamed to drive out the air. During this process (exhausting) the dissolved and enmeshed air is driven out and the air in the empty space at the top of the can is displaced by steam. After exhausting, the can is removed from the cooker and sealed as quickly as possible. It is then returned to the pressure cooker and processed, i.e. heated under pressure in order to sterilize the contents and complete the cooking of the meat. The period of processing depends on the pressure employed,

the type of pack and the size of the can. For this type of pack in a No. 3 can, a processing period of one hour at 10 lb. pressure is satisfactory. At the end of the processing period, the can is removed from the cooker and immediately plunged into cold running water in order to prevent further cooking. The can is removed from the cold bath when still somewhat warm and wiped dry. Sufficient heat should be retained in the can to ensure rapid drying of the outside surface. The contents will remain in excellent condition for years if stored in a cool dry place. Chicken canned in this manner is pleasing in appearance, soft and tender in texture and very palatable

Disjointed chicken: In this pack the quality of the birds should be of the same type and standard as that for whole chicken. The drawn carcass, prepared as for the former pack, is disjointed by separating the thighs, drumsticks, wings, breast and back. The ribs are rejected. Damage to the skin during plucking or the size of the hole through which the evisceration of the carcass was carried out does not affect this method of packing since the carcass is cut up before packing. The pieces are packed into suitable cans, jellying material added and the rest of the process, viz. exhausting, sealing, processing and cooling carried out as described above. A 3 lb. chicken, when prepared in this manner, fits into a No. $2\frac{1}{2}$ size can. The processing period for a No. $2\frac{1}{2}$ can is 45 minutes at 10 lb. pressure.

Boned chicken: This type of pack is not usually rated high during normal times from the commercial point of view and is employed in the case of birds unfit for the former two types. A satisfactory product can be obtained from older birds by this method. Young birds would naturally give better material but, since the two former methods of packing are commercially more profitable, only older birds (i.e. more than 5 months old) are generally employed for this type of canning. In this method the procedure is somewhat different from those already described. The drawn carcass is cooked preferably under pressure, sufficiently to enable the meat to be stripped off the bones easily. The meat is packed into suitable cans and pressed as tight as possible, jellying material added and the exhausting, sealing, processing, etc. carried out as described above. In the case of old hens, particularly, there is considerable amount of fat which has to be rejected, as fat, when packed along with the meat, gives it an undesirable flavour.

The preliminary cooking period is determined by the age, size and condition of the birds ; old, fat ones requiring more time than young, tender ones. With the latter type of birds about 15 to 30 minutes at 10 lb. pressure are usually ample while in the former case cooking may take an hour. This being a solid or tight pack very little filling material is required. Jellying material is ideal but in its absence broth (obtained during the pre-cooking of the meat) is quite satisfactory. It has been found that all the meat of a $4\frac{1}{2}$ lb. cockerel can be packed into a No. 2 size can. With this size of can and type of pack, the period of processing required for ensuring complete sterilization of the contents is one hour at 10 lb. pressure.

In all the above packs only a teaspoonful of salt is added as flavouring. When plain tin cans are used there is a tendency for brownish spots to appear on the surface of the material when the can is opened. This is due to the action of the sulphur of the meat on the iron of the tin. The spots have not been found adversely to affect the flavour but may lead the consumer to suspect the quality of the material. The remedy is the use of cans coated internally with sulphur-resistant lacquer.

When chicken meat is packed in any of the above three forms care has to be taken that the neck and giblets (the name usually given to heart, liver and gizzard) are not included as they tend to discolour the meat and thus spoil the appearance of the pack. The liver also tends to impart its characteristic flavour and taste to the whole pack. These by themselves are edible meat and can be readily sold. The liver is particularly valuable as it is highly prized in western countries.

By-products

In the canning of chicken a number of valuable by-products are also obtained, among the most important of which are chicken essence and chicken jelly. The broth that is obtained during the pre-cooking of the meat, when freed from the fat and clarified and concentrated, if necessary, gives a valuable product which is much used as a 'pick-me-up' for invalids. The head, shanks, feet, bones, skin, etc. when digested with water under pressure yield a very valuable jelly that can be used as stock for soups.

SWEET POTATO : AN EMERGENCY CROP

By K. K. Guha Roy

Librarian, Imperial Agricultural Research Institute, New Delhi

POTATO is known to be one of the substitute emergency crops, which is on the programme of the grow more food campaign. But the claims of sweet potato [*Ipomeae batatas* (Linn.) Lam.], more nutritious than potato as will be seen from the table below*, and also pleasant to the taste, stand high as a vegetable having the essential emergency requisites of being a quick grower, yielding large returns, and needing for its growth only a small quantity of water. It is a pretty hardy crop and can be grown successfully in almost all climates and soils, and practically without manure. Moreover, it has been, even in normal times, a poor man's food and is considered as a part of his staples.

There are many varieties grown in India. They vary in size, shape, colour, taste and flavour. The white and the red are the most common. The red variety is sweeter and eaten either raw, scorched or boiled.

* Nutritive Value

	Moisture per cent	Protein per cent	Fat (Ether Extractives) per cent	Mineral matter per cent	Carbohydrate per cent	Calcium (Ca) per cent	Phosphorus (P) per cent	Iron (Fe) mgs. per cent	Calorific value per 100 gm.
Potato	74·73	1·73	0·13	0·61	22·80	0·004	0·034	0·68	99·3
Sweet Potato	66·51	1·24	0·32	0·04	30·89	0·017	0·050	0·79	131·4

Soils and climate

Sweet potato can be grown with fair success on a wide variety of soil types provided the soil is well drained. In general, light sandy loam soil produces the best quality. Alluvial land is not considered suitable for quality production, whereas silt loam soils give high yields. Heavy yields of sweet potato cannot be expected on very sandy soils. It has been found to grow even on clay soils and the outturn is much larger than on ordinary sandy loams. It can be grown even on the sea coast, a saline atmosphere being rather beneficial than otherwise to the crop. A soil rich in organic matter invariably results in heavy growth of vines and small tubers.

Sweet potatoes thrive best where the growing season is long and warm. After the plants have been well established, they can withstand periods of drought successfully. Sweet potatoes are more productive in dry seasons than in wet ones. If there is too much rain, excessive vine growth is produced and the tuber yield reduced. Best quality tubers are produced in dry seasons.

Cultural operations

The sweet potato is propagated from cuttings of semi-mature portions of the stem. It is better to use the apical (top) cuttings, since earlier growth and heavier yields are obtained than with middle or basal cuttings. Philippine agriculturists recommend this practice and forbid the use of basal cuttings as of no economic value.

Sweet potatoes require relatively little cultivation. About two shallow cultivations should be sufficient to control weeds and grass until the vines cover the ground after which they will usually take care of themselves.

Before planting, the land should be ridged, the ridges being spaced from 2 to 3 ft. from centre to centre and raised to a height of 1½ to 2 ft. The usual distance of planting along the ridges is 15 in. The soil must be well pressed round the cuttings to prevent them from drying out; planting should therefore be carried out during wet weather when the cuttings should take root readily. The cuttings strike root easily in about a week, and the plant grows vigorously afterwards. The after culture is very simple. The weeds will have to be removed from the land during the initial stages of its growth.

Generally the cuttings are planted during the rainy months of August and September and the plants need not be watered. In the absence of rains for long intervals, say of two

* Taken from *Health Bulletin* No. 23, p. 26, 1937.

weeks or more, it is necessary to irrigate the field about once a week. A small quantity of water will be sufficient to moisten the soil ; the fields need not be flooded. The cuttings must be planted on loose moist ground.

Sweet potatoes will grow and usually produce a crop even on poor soils without manuring ; but best results cannot be expected under these conditions. Good land is essential, if high yields are to be obtained. Cattle or farmyard manure or compost applied at the rate of 10 tons per acre has been recommended, but considering the low return in economic value this expenditure is not warranted. The alternative is a suitable rotation. This crop is generally recognized as a heavy feeder and may deplete the nutrient reserves in the soil, if it is grown on the same soil without fertilization for a number of years successively. As the shape of the roots produced depends, to some extent, on the looseness of the soil, green cover crops turned under are beneficial especially on the heavier types of soil.

Harvesting

Ordinarily the crop is ready for harvest in about three to four months from the time of planting. When the crops have matured, the leaves begin to turn yellow and wither. To ascertain whether the crop is ready for lifting a few tubers are examined. If they are cut through and the sap dries rapidly forming a white crust, the plants are mature and the tubers may be lifted. The crop must be lifted as soon as mature. The most satisfactory implement for use in harvesting is the Assam fork, which ensures the tubers being lifted with the minimum amount of damage. Hand-digging and lifting are also resorted to. The tubers after lifting should be cleared of all soil.

Outturn and yield

Yields vary from soil to soil and locality to locality. The average outturn in America is said to be four to five tons per acre under favourable conditions. In Malaya under Chinese farming six tons per acre have been recorded. In South India the average is said to be about four to five tons, which is capable of being doubled with careful cultivation and good manuring. Mr N. G. Mukerjee's estimate, as given in his *Handbook of Indian Agriculture* was 100 to 300 md. per acre. Acre to acre and bulk to bulk, sweet potatoes yield much more than any other food crop within a comparatively short period of time.

Extension of the cultivation of this crop will not only tend to relieve the present distress in the famine stricken areas but will also largely contribute to the relaxation of heavy demand on ordinary potatoes by the army, whose claims are as paramount as those of the starving millions.

LEAF-CURL DISEASE OF TOBACCO IN INDIA

By HEM SINGH PRUTHI, PH.D., SC.D. (Cantab)
Imperial Agricultural Research Institute, New Delhi

TOBACCO is known to suffer from a virus disease causing curling of leaves, twisting of stems (figs. 2 to 6) and in severe cases, considerably inhibiting the growth of the whole plant in several parts of the world, e.g. India, Java, Rhodesia, etc. The disease is, however, known by different names in various countries, i.e. as 'leaf curl', 'leaf-crinkle' and 'leaf-frenching' in Rhodesia, Tanganyka and South Africa, and as 'kroepoek' in Java and Sumatra.

Economic loss

In India, the disease is most common in the Gangetic delta, including Bihar in the east and Sind and Baroda in the west. It sometimes assumes an epidemic form, 60 to 70 per cent or more of plants being attacked. The cigarette varieties of tobacco are specially susceptible to the disease. Fortunately in the Peninsular India, particularly the Guntur district (Madras presidency), where the largest quantity of cigarette tobacco is cultivated every year, this disease is not common.

The leaves of diseased plants get coarse, thickened and puckered and cannot be flue-cured satisfactorily and as the value of tobacco crop is almost entirely dependent on the quality and texture of its leaves, the enormous economic loss which leaf-curl disease is causing to the cultivators in India can be easily imagined.

Most of the virus diseases of plants are known to be spread by the agency of insects, particularly those which suck plant-sap rather than bite leaves, stems, etc. Thrips, aphides, leaf-hoppers and white-flies are important categories of sucking type of insects.

Extensive investigations

In view of the great economic importance of tobacco leaf-curl disease in India, extensive investigations have been carried out by the Entomological Section of the Imperial Agricultural Research Institute at Pusa during the past six years to discover the insect vector concerned in the transmission and spread of the disease, and alternate plant hosts of the vector and the disease. The bionomics of the vector have also been carefully studied in the tobacco fields with a view to evolving suitable control methods for reducing the intensity of the disease to the minimum. The Imperial Economic Botanist and the Imperial Mycologist have carried out investigations from their respective view-points. The results of the entomological investigations are summarized below[1].

According to symptoms, there are five types of leaf-curl in northern India designated as A, B, C, D and X, the last named being the mixture of two or more types. It is not yet known whether each of the four types is caused by a specific virus, but all of them can be transmitted by a single species of insect vector. It, however, appears that if the viruses are not distinct, they are at least different strains of the same virus.

Important insect vectors

To discover the insect vector or vectors of the disease, a thorough collection of the insect fauna found in tobacco fields was made at different times of the day throughout the season. The following insects of sucking type were found most common: (I) The Capsid, *Cyrtopeltus crassicornis* Dist. (ii) The white-fly, *Bemisia tabaci* (Gen.) (iii) The aphid, *Macrosiphum* sp.

A large series of transmission experiments performed during 1935-36 to test the Capsid bug as a vector of leaf-curl gave negative results on the whole, whereas those performed with the white-fly during 1936-37 gave a fair percentage of positive results.

Extensive transmission experiments were performed with the white-fly in the subsequent two seasons and it was conclusively proved that this insect species was the most important vector concerned. In Java and Africa also the white-fly is considered to be the vector of tobacco leaf-curl or crinkle.

Alternate hosts

As regards alternate hosts of the tobacco leaf-curl virus, sunn-hemp crop at Pusa was

[1] *Indian Journal of Agricultural Science*, Vol. VII, pp. 659-670, 1937; Vol. IX, pp. 223-275, 1939; Vol. II pp. 387-409; 1941, Vol. XII, pp. 35-57, 1942.

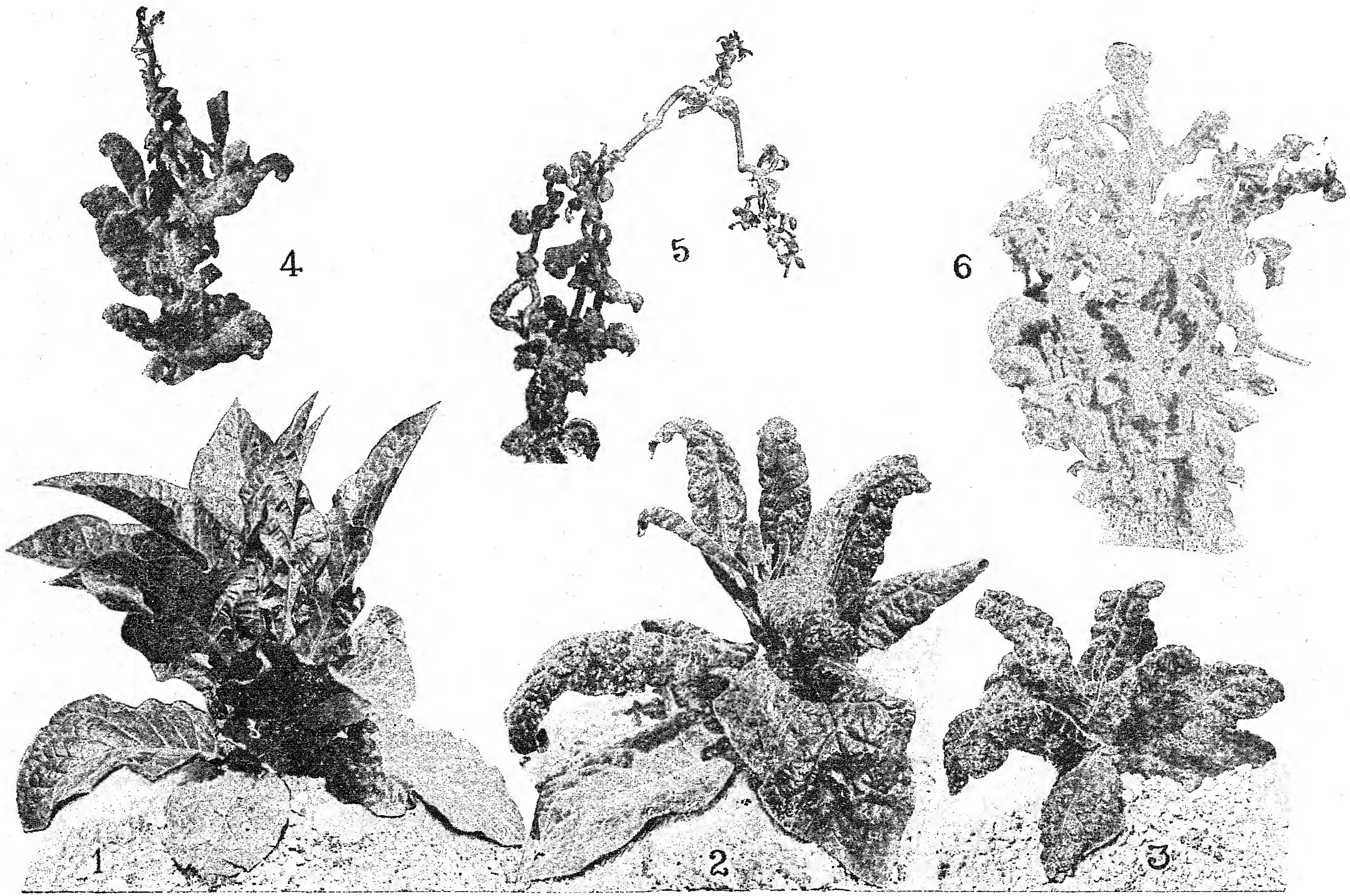


FIG. 1. A healthy tobacco plant (photo.)
FIGS. 2-6. Tobacco plants suffering from various types of leaf-curl disease (photo).

An Experiment in Agricultural Education, P. 240.

A girl of 14 driving a tractor

[Photo by courtesy of the Editor *Farmer's Weekly*]

PLATE 22

observed in the summers of 1935 and 1936 to be heavily suffering from a leaf-curl disease resembling that of tobacco. The white-fly *B. tabaci* was the most common insect found in the affected fields. Suspecting that sunn-hemp might be an alternate host of the tobacco disease, white-fly specimens collected from the diseased sunn-hemp plants were introduced on tobacco seedlings raised in sterilized soil in pots enclosed in insect-proof muslin cages. Within a few weeks, 90 per cent of the tobacco seedlings developed typical symptoms of A-type disease.

A thorough survey of other host-plants, cultivated and wild, of the white-fly was made in the environs of Pusa. Over hundred such hosts of the white-fly have been discovered of which at least 12 showed symptoms of leaf-curl disease reminiscent of tobacco leaf-curl. The more important of these were critically examined by performing series of transmission experiments to determine, whether they were really the alternate hosts of tobacco leaf-curl virus and whether the white-fly was the vector concerned in the transmission of the disease from them to tobacco and *vice versa*. The important alternate hosts of the disease thus discovered are listed below, indicating the type of tobacco disease they harbour and the maximum percentage of successful transmission obtained in each case.

Diseased plant used as source of infection	Types of disease developed on tobacco	Transmission of the disease from tobacco back to alternate hosts
Crotalaria juncea (Sunn-hemp)	A and X	18 per cent
Ageratum conyzoides	D	100 ,,
Zinnia elegans	C, D and X	100 ,,
Solanum nigrum	B, C, D and all the three often mixed with X	..
Euphorbia hirta	B, in a few cases C and both often mixed with X	..
Vernonia cinerea	A and C and both mixed with X	..
Lycopersicum esculentum (tomato)	A	..
Launea asplenifolia	X and sometimes DX also	..
Sida rhombifolia	C and sometimes A also	..
Scoparia dulcis	X	..

It will be noticed that there is at least one alternate host, if not more, for each type of tobacco leaf-curl. The weeds *Ageratum*, *Euphorbia*, etc. and cultivated plants like sunn-hemp, zinnia, etc. are very important from this point of view. Furthermore, it was determined by experiment that the disease can not only be transmitted to tobacco from the hosts named above, but from one alternate host to another and in some cases the alternate hosts had hosts of their own.

Seasonal history

In chart 1, the seasonal histories of tobacco and the various alternate hosts of leaf-curl are diagrammatically shown. A glance at the calendar shows that during the four months of February-May practically no alternate host plant exists in the field, and there is no tobacco crop in the field or nurseries between June and the middle of August. Therefore, the alternate hosts actually dangerous to tobacco are those which show the disease in August-November.

Tobacco is sown in Bihar in nurseries late in August and transplanted in the field, in the end of September. The leaves start getting suitable for curing from the end of January. The crop is in flowers in February and over by the middle of April.

It was observed that the rate of increase in the incidence of leaf-curl disease is highest in October-November, lowest in December-January and again there is a flush in March when mostly side-shoots are affected.

The large series of transmission experiments with tobacco seedlings of different ages carried out at different times of the year also showed that tobacco is most susceptible to disease when 8 to 10 weeks old and the symptoms are best developed when the temperature and humidity are moderate approximating to those prevailing in Bihar in autumn, rather than when it is too hot or too cold and dry.

The white-fly

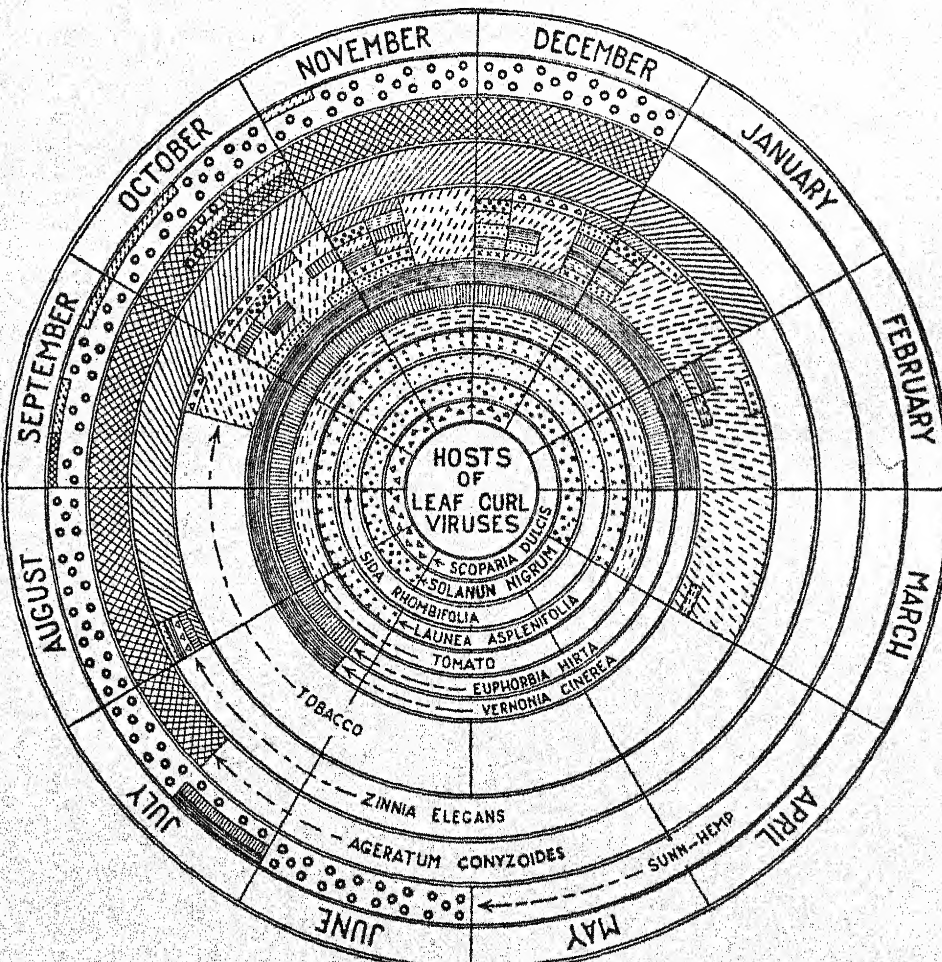
Regarding the white-fly, its population is also highest in tobacco fields during early autumn (September-October) and in the laboratory it reproduces most rapidly when the weather is warm (about 80°F) and relative humidity is about 80 to 90 per cent. The experiments have shown that even a single individual white-fly is capable of transmitting the disease from one plant to another; of course, the larger the number, the greater the chances of their spreading the disease. About 15 minutes' feeding on the diseased plant was

enough to make the white-fly infectious, which remained so in the rest of her life which, however, seldom exceeded a week.

The nymphs or immature stages of the white-fly are not active, neither do they move from one plant to another and therefore, are hardly of any importance in the spread of the disease. The disease is also not transmissible from one generation to another through the egg.

Vernonia, *Euphorbia*, *Ageratum*, *Anisomeles*, *Launea*, *Scoparia*, etc. The white-fly multiplies rapidly on these plants until September; then there is a gradual decline in number until November. When tobacco seedlings are transplanted in the field about the end of September, the white-flies start migrating from *Duranta*, sunnhemp, *Ageratum*, Launea and all the above named weeds to young tobacco plants about

CHART I



Seasonal histories of tobacco and various alternate hosts of leaf-curl.

The life-cycle of the white-fly vector lasts for 16 to 39 days during August-March and there are 12 broods in a year. The white-fly first appears in June on sunn-hemp when it is about two months old. On *urid*, *patwa* and *arhar* it appears early in August, having migrated to them from Duranta, *Solanum nigrum*,

the first week of October when the latter are 6 to 8 weeks old. The adults of the first brood on tobacco appear about the middle of November. Four to five generations are thus completed on tobacco crop up to the end of March; the remaining generations are obviously completed on its other hosts when tobacco is not

in the field. When tobacco is harvested, the white-flies migrate back to *Launea*, *S. nigrum*, *Euphorbia*, *Duranta*, *Ageratum*, etc.

It may be added that this white-fly (*B. tabaci*) is extremely common in cotton fields in the Punjab and Sind and in fact is popularly called 'Cotton white-fly' in these areas and even specialists[1] considering it to be a new species described it as *Bemisia gossypiperda*. Fortunately in the case of cotton, this white-fly is not yet known to cause any virus disease in India. In the Sudan, a virus disease is associated with this or an allied species of white-fly.[2]

Control measures

As regards the control of the disease, in Java and Africa, where the disease has also been found to have some alternate hosts, eradication of all such hosts and thorough removal of tobacco stubbles after harvest have been recommended as control measures. Evidently alternate hosts are comparatively fewer in those countries than in India or all the alternate hosts have not been thoroughly investigated. As already stated, we have found about a dozen important alternate hosts of the disease in this country, a number of them being weeds, the eradication of which is economically impracticable. Further, the disease is more readily transmitted from other plants to tobacco than from tobacco to tobacco. Therefore, removal of tobacco stubbles is not likely to ensure effective control of the disease. Furthermore, as the list of the food-plants of the white-fly vector is over 100, even if we eradicate the dozen important ones referred to above, the white-fly is able to thrive almost throughout the year. It is possible that the plants which are unimportant alternate hosts may assume a status of importance.

The possible lines of controlling the disease lie in evolving resistant varieties of tobacco or in decreasing the population of the vector by means of spraying or dusting at suitable times in the tobacco season.

Insecticidal methods

Regarding the efficacy of insecticidal methods of white-fly control and thereby the spread of the disease, as the tobacco crop is susceptible to disease when 8 to 10 weeks old, it is obvious that the infection takes place even when the crop is in the nursery stage. Therefore, the operation have to be started right from the very beginning when the crop is in seed-beds. From this time, if dusting or spraying is carried out at an interval of about 10 days for about two months, there are reasonable chances of reducing the white-fly population to the minimum, and thus decreasing the virus disease on a large scale. Small-scale field experiments on these lines have been carried out at Pusa during the past two seasons and the results are encouraging. Of the two insecticides tested, rosin compound seems to give better results than nicotine sulphate. As the time of the growth of tobacco is different in various parts of the country and as the effect of the spray depends on the age and texture of the leaves, carefully planned experiments on field-scale have to be carried out in various parts of the country before definite control measures suitable for various provinces and states can be recommended.

[1] Misra and Lamba, *Agric. Res. Inst., Pusa* Bull. No. 196, 1929.

[2] Kirkpatrick, *Bull. ent. Res.* 22, 323-63, 1931.

IMPROVEMENT OF LINSEED IN THE UNITED PROVINCES

By

T. S. Sabnis, B.A. (Hons.), D.Sc., F.A.Sc., I. A. S., *Economic Botanist*

and

T. R. Mehta, B.Sc., Assoc., I.A.R.I., *Research Assistant*

Cawnpore, United Provinces

NEXT to mustard and rapeseed, linseed is the most widely cultivated oilseed in the United Provinces. It occupies an area of about 9,00,000 acres which is approximately $2\frac{1}{2}$ per cent of the total cropped area of the province. About 22 per cent of the area under linseed in India occurs in the United Provinces and it comes next only to that in Central Provinces which is 28 per cent. But in the matter of production, United Provinces ranks first, contributing 30·9 per cent of the total produce, followed by Central Provinces and Berar which contribute 17·9 per cent.

Distribution of area

There are three main linseed growing tracts in the United Provinces, viz., north-eastern, central and southern (or Bundelkhand) districts. The first includes the important districts of Gonda, Gorakhpur, Bahraich and Basti and contains nearly 48 per cent of the total area. The second includes Mirzapur, Allahabad and Benares and contains about 18 per cent of the area. The last contains the districts of Jalaun, Hamirpur, Banda and Jhansi which contain about 26 per cent of the area.

Quality

The varieties grown are of the brown-seeded kind. Most of the linseed grown in the north-eastern districts is small-seeded, falling in the trade grade Calcutta Small, giving on an average 180 to 200 seeds per gramme. The varieties are high yielding and generally late, being harvested in the latter half of March. The linseed grown in the Central districts is bolder, falling in the grade Calcutta Bold or Bombay Bold, giving on an average 154 seeds to a gramme. The linseed grown in Bundelkhand is bold-seeded, falling in Bombay Bold class and giving on an average 110 seeds to a gramme. The varieties are early, poorer in yield and are ready for harvest about 3 to 4 weeks earlier than the small-seeded linseed.

Breeding rust-resistant types

Among the problems of improvement is that of breeding the rust-resistant types. A number of crosses between Indian linseeds and imported flax types were effected in 1924-25. The flax types were resistant to rust, but were very late in maturity, were tall and gave lower seed yields, the seed being medium in size and of lower oil content as compared to the indigenous parents which, while possessing the desirable characteristics of early maturity, satisfactory yielding capacity, bold seed size and high oil content lacked resistance to rust. They were besides short and unsuitable for fibre production.

The following crosses were effected in 1924-25.

Atarra	× *Levant* and reciprocal
Rath	× *Levant*
Levant	× Bhopal White and reciprocal
Levant	× Bhopal Red and reciprocal
Levant	× Jaitipur and reciprocal
Morocco	× Bhopal Red
Rath	× *Morocco* and reciprocal
Jaitipur	× *English*

(The names in italics represent flax parents)

Besides the differences noted above, the two parents in certain crosses differed markedly in flower and seed colour. It is not necessary to enter into details of these parental characters and the way they were transmitted from generation to generation. Suffice it to say that wide variations were observed in the populations of the second and subsequent hybrid generations with regard to the different characters. The majority of variants, however, represented combination of characteristics which could not be considered of economic significance. Ruthless discards of such plants were made year after year, till only about a dozen of the forms are now left. Of these, four strains, viz. C1150, C1193, C1196 and C1206, all of which are bold-seeded and good yielding types, have been under field-scale trials and multiplication since 1933-34, the first three

being brown-seeded and the last named light yellow-seeded. C1150 and C1193 are expanding in Mirzapur district and in Bundelkhand. The former is the product of the cross Atarra (local) × *Levant*, and the latter of Jaitipur (local) × *English*. Though the flax parents were late, these types are as early as the local linseeds which mature in about four months, being harvested late in February or early in March. They are rust resistant, at least as far as their cultivation in United Provinces is concerned. Whether they would maintain their resistance when grown in other provinces (where they would be subjected to different soil and climatic conditions and perhaps to different physiologic forms of the rust) yet remains to be seen. Their resistance to rust was strikingly manifested in 1933-34 at the Research Farm, Cawnpore, when a severe out-break of rust occurred in the linseed cultures. B. B. Mundkur, then Second Assistant Mycologist, Imperial Institute of Agricultural Research, Pusa, examined the linseed plots and reported as follows :

'On the request of the Economic Botanist (Oilseeds) his linseed plots were examined for rust. Rust was in a severely epidemic form both at Cawnpore and Aligarh. Rust was bad on the following Pusa varieties : Pusa 11, Hybrid 68, Pusa 10, 21, 55 and T124. The local types, isolated by the Economic Botanist viz. 1193, 1196, 1150 and 1206 were perfectly free from rust and showed a degree of resistance verging towards immunity. These resistant types were growing in very close proximity to the affected types. I am told that agronomically they are quite good.'

The types C1150 and C1193 have been thoroughly compared against the local linseeds in Mirzapur from 1938 to 1941 on cultivators' fields and have yielded on an average 10 to 15 per cent higher produce of seed. During three years 1934-35, 1935-36 and 1937-38 type C1193 yielded 27 per cent higher than the local variety in replicated varietal trials at Bichpuri Farm, Agra.

Further selection

From the segregation of characters of the hybrids it was apparent that the genic differences between the parents were considerable with the result that great variations were commonly encountered within the several families raised year after year. The above four types looked fairly uniform, the variations in each being within narrow limits. Further selection of single plants was started in 1939-40 to discover how far these variations were genetic and to isolate yet better forms if possible. The study of progeny rows in 1940-41 and 1941-42 revealed that the variation was genetic to some extent. One of the variants of C1193, viz. C1193-1 has been specially selected. Whereas the hybrids are tall-growing as compared to the local linseeds of Bundelkhand and Central United Provinces (Mirzapur and Allahabad) for which areas they are specially recommended – C1193-1 is uniformly taller than the original C1193. Besides, the main stems start branching much higher up (a characteristic of the flax parents) as compared to the local varieties which besides being shorter start branching much lower down.

The comparison of the heights of the plants and the 'branching height' (i.e. the height at which the main stems start branching) of C1193-1 with a local variety from Mahoba (Hamirpur, Bundelkhand) is given below. The heights were measured in 30 plants in each type in adjacent plots in a varietal trial laid down in 1942-43. In each plant three main stems were measured for total plant height and the 'branching height', averages of the three measurements worked out and then averages per plant calculated for each type.

The average plant heights and branching heights, each based upon 90 measurements, in C1193-1 and Mahoba were 63·8 cm. and 40·6 cm., and 55·7 cm. and 24·7 cm., respectively. In C1193-1 the branching is, as it were, concentrated near the top, and the pods are formed closer together, whereas in Mahoba the branching starts low down on the stem, is lax and the pods widely spaced. The concentration of pods in C1193-1 is desirable in so far as it would cause less damage to the straw in threshing with sticks when the straw is intended for fibre extraction.

In view of the fact that extraction of fibre from linseed straw is an attractive proposition, especially when demand for such fibre in India is great on account of the present war, C1193-1 is one of the linseeds which can serve the dual purpose of yielding oil as well as fibre. Since only that portion of the stem which lies below the zone from which branches shoot out is suitable for extraction of fibre for spinning and weaving purposes, it is apparent that C1193-1 is considerably superior to the cultivators' linseeds, possessing as it does a greater branching height. Although much taller hybrids are available and are being tested, they are not as early as C1193-1 and would not be easily able to

find acceptance from growers of linseed in Bundelkhand and Central United Provinces where early bold linseed is grown. However, these later, tall hybrids may suit the north-eastern districts. As soon as the tests with such strains are completed and the best strains picked out they will be tried in those districts. For the present only C1193-1 has been taken up for multiplication. As stated earlier, it differs from the original C1193 in just being a more uniformly tall strain while retaining its seed yielding property as revealed in replicated trials conducted in 1941-42 at Kalianpur Farm, when the yield per acre of C1193 was 1,136 lb. and the yield per acre of C1193-1 was 1,368 lb. With its satisfactory seed yield and straw length, and earliness, it would be a good substitute for flax which offers difficulty not only on account of its long duration especially in areas which prefer short duration rabi crops, but also on account of its poor merit as an oil yielding crop.

Only about 100 lb. seed of C1193-1 was available in 1942 and it has been used for trials and further multiplication. It is expected that about 5,000 lb. seed will become available this year for sowing in October 1943.

A comparison of seed size and oil content of C1193-1 and the local linseed of Jhansi showed that the two varieties are similar in possessing about 110 seeds to a gram and an oil content of about 44 per cent.

NUTRITIONAL MERIT OF VEGETABLES

GRADED as sources of vitamins A and C and iron and calcium, vegetables, cooked or raw according to customary usage, were arranged in the following order of merit as protective foods at the recent meeting of the Nutritional Panel of the Society of Chemical Industry, London, Eng. First came the green vegetables, broccoli tops, watercress, mustard and cress, brussels sprouts, and spinach, rich in carotene, and very rich in Vitamin C, and containing useful contributions of iron and calcium, although it was doubtful whether the calcium in the spinach was utilizable.

Next came cabbage and cauliflower which still contained substantial amounts of vitamin C but negligible quantities of carotene. In green vegetables, carotene is associated with greenness. When the heart of a cabbage is blanched, it thereby forefeits its rank in the highest class of protective vegetables.

Tomato and lettuce fell in the middle of the list. They contained more carotene but much less vitamin C.

Vegetables with only one-fifth of the concentration of green were placed at the bottom of the list, namely, turnips, green peas, radish, leeks, parsnips, string beans, and onions. Asparagus, cucumber, celery, and marrow contained so little vitamins or minerals they they could not be graded at all, said the report. —*Department of Agriculture, Canada.*

POTATO MANURING IN ASSAM

By L. N. Phukan, B.Sc.
Agricultural Chemist, Assam

The present area under potato in Assam is 51,490 acres and the average yield per acre is estimated at 60 to 70 mds. It is grown both in the Hill districts, especially in the Khasia and Jaintia Hills, where it is mainly grown as a summer crop and in the plains areas of Brahmaputra and Surma Valley where its cultivation is strictly confined to the new alluvial soils and is grown entirely as a winter crop.

Manuring

Potato requires intensive cultivation and responds remarkably well to manures. In fact, it is liberally manured by the cultivators as far as manures are available to them. The present manurial schedule as adopted by the cultivators consists of an application of well-rotten cowdung, not more than 100 mds. per acre on the average. Oilcake, excepting in a very few localities of Surma Valley, and other manures including artificial fertilizers are seldom used.

From a series of manurial experiments conducted at the Upper-Shillong Farm in the K. and J. Hills, it has been definitely found that potato requires very liberal dressings of manures to get a satisfactory yield and from these it appears that the present rate of manuring, adopted by the cultivators, falls far short of the optimum dose. Assam has considerable areas for expansion of potato cultivation and the yield of the crop within the present cultivated area can be very considerably increased by following a proper manurial schedule. It may easily be possible to increase the present yield by hunderd per cent and to obtain an average yield of at least 150 md. crop per acre by proper manuring.

Soil analysis records

It will be interesting to go through the records such as given below, of mechanical and chemical composition of a few typical potato tracts of the province.

Analysis of Potato Soils

Mechanical analysis	Upper Shillong Farm Top soil (K & J Hills)	Pukra near Mao Top soil (Naga Hills)	Kakila-mukh Top soil (Brahmaputra Valley)	Majuli Top soil (B. Valley)	Karimganj Top soil (Surma Valley)
Coarse sand	5·20	3·30	0·20	1·70	2·80
Fire sand	17·90	23·80	25·80	53·45	41·50
Silt	21·60	18·00	37·30	18·95	26·70
Fine silt	31·90	27·30	28·50	19·45	18·85
Clay	16·10	17·70	3·90	5·15	8·80
Moisture	6·60	7·40	1·80	1·40	1·70
Loss on Ignition	10·40	14·80	4·00	3·00	2·40
Chemical Analysis					
Nitrogen	0·34	0·44	0·13	0·11	0·12
Available P_2O_5	0·019	0·023	0·045	0·064	0·008
Available K_2O	0·009	0·018	0·25	0·012	0·005
Acidity in parts CaO per million Soil parts	1070	1518	6	39	78

K. and J. Hills soils

Geologically the K. and J. Hills belong to very old origin where the soil is almost everywhere lateritic. The physical condition of the soil is fairly good representing a loamy texture which can be worked with ease. The amounts of organic matter and nitrogen appear to be very high in these soils but considerable quantities of these are of very doubtful character and possibly consist of very old residues undergoing mineralization to a high degree. The area under potato cultivation here is 10,000 acres.

In the existing condition of the soil, nothing can be grown successfully without the fresh addition of organic manures. Cowdung or well prepared compost is, therefore, primarily required for manuring the potato crop. The percentages of phosphoric acid and potash are fair. The crop however responds markedly to potash especially in the lighter soils whose potash content is generally low. The Khasi cultivators adopt *jhum* cultivation which consists of collecting leaves and twigs of trees on the potato fields and burning them prior

to the preparation of the land, whereby considerable quantities of potash are added to the soil. It may be noted that the cultivators in the plains also use some amount of wood ash along with cowdung.

Organic manures

From the results of manurial experiments at the Upper Shillong Farm, it has been found that cowdung, compost and mustard oilcake which are locally available are the best organic manures suited to the crop. A mixture of cowdung or compost at 300 mds. per acre and mustard oilcake at 10 mds. per acre, equivalent to about 160 lb. nitrogen per acre has been found to be the best combination. Compost, rightly prepared, has great possibilities on account of general insufficiency of cowdung for large scale manuring. The dose of oilcake may be proportionately increased up to a maximum of 30 mds. per acre, if sufficient cowdung or compost is not available but as a rule, at least 100 mds. of cowdung or compost is required, even if the bulk of manuring is to be done by oilcake. Much depends, however, on the quality of these stuffs and the method and time of application ensuring a thorough incorporation of the manures with the soil at the right time.

Inorganic manures

The organic manures, referred to above, mainly supply nitrogen and very little of phosphate and potash which are also required for the crop. It is expected that a mixture of organic and inorganic manures will give better results than organic manures alone. Besides, potato being a crop of very short duration, the quick-acting fertilizers are likely to be of particularly beneficial effect. Definite experiments on this line will be taken up at the Farm but till now some of the artificial fertilizers have been found to be very effective.

The artificial fertilizers are however to be carefully selected as they are easily soluble and are consequently liable to be washed out, especially, in the undulating soils of the hills, and, during the rains when the crop is mainly grown. For instance, sodium nitrate although supplying readily available nitrogen has been found to be no good for the hilly tracts. On the other hand, the compound fertilizers of nitrogen and phosphate, such as Nicifos and Ammophos, have consistently given very satisfactory results. Fertilizers containing potash have also been found to be quite suitable in combination with nitrogenous and phosphatic fertilizers.

Organic and Inorganic manures

In the absence of sufficient quantities of organic manures these fertilizers can be freely used. Best results are however obtained when they are used as supplementary dressings to an initial application of organic manures. A combination of 100 mds. cowdung, 200 lb. Nicifos 11 (22/18) and 200 lb. sulphate of potash supplying 76 lb. nitrogen, 36 lb. P_2O_5 and 96 lb. K_2O per acre has been found to be a very suitable dressing for potatoes in K. and J. Hills which is also quite remunerative. The pre-war prices of Nicifos and sulphate of potash were Rs. 205 and Rs. 285 per ton, respectively and the approximate cost of the mixture of Nicifos and sulphate of potash at 200 lb. each comes to Rs. 36. The average increase due to this combination was about 3,000 lb. of potatoes per acre over the control treatment receiving 100 mds. cowdung only, based on the results of three successive trials on up-to-date methods. The minimum value of the increased crop will be Rs. 100 giving a net profit of Rs. 60 per acre for manuring alone.

Hills and valley soils

The soils of Naga Hills, being of recent geological origin, are more fertile. Nitrogen content of these soils is very high and of a more effective nature. These soils are also rich in phosphate and potash. No definite manurial schedule has been worked out for these soils but a similar one with lesser quantities of manures is likely to respond well. The area under potato in the hills is very small, about 120 acres but its cultivation is being gradually extended.

In the plains potato as cannot be grown on the old alluvial tracts as termites are a severe menace to the crop irrespective of the fertility of the soil. It is mainly grown in the new alluvial riparian tracts which, more or less, remain inundated during the rainy season. These soils are of very light texture containing a very low percentage of clay. The organic matter and nitrogen contents are also low and the crop responds remarkably well to organic manures and other nitrogenous fertilizers on these soils. In the Brahmaputra Valley, the phosphate content of the alluvial soils is fairly high unlike that of Surma Valley. Potash is

comparatively lower on account of the light texture of the soil. No definite manurial schedule has been worked out for these soils, excepting a manurial experiment for one year, wherein a mixture of cowdung 200 mds. and Red Label Mixture (11·5 per cent N) 700 lb. supplying 160 lb. nitrogen per acre, gave an increase of 2,800 lb. of potato per acre over control receiving no manure. In the same experiment, the mixture of cowdung 200 mds. and oil cake 20 mds. supplying 160 lb. nitrogen per acre gave an increase of only 2,064 lb. over control.

Possibilities

There are vast tracts of hilly and riparian areas in Assam which can be brought under cultivation of potato and, with adequate manuring, a bumper crop much to the credit of the province can be easily obtained both for her own consumption and for export to other parts of India. Assam is preeminently suited for the cultivation of potato in selected areas of the province and suitable manurial schedule is well worth working up in all details for different localities as manures are indispensable for the crop.

GROW CERTIFIED SEED POTATOES

THE production of certified seed potatoes should be regarded as a special business requiring time, some knowledge of the business, and patience, as well as proper location, soil, and equipment, for this exacting trade. It should not be entered into lightly by any grower, just because he can grow potatoes, because it would only lead to disappointment for many whose crops may be rejected on inspection if the job is not done just right, states John Tucker, Manager, Seed Potato Section, Special Products Board, Dominion Department of Agriculture. However, with keen interest and hard work it is usually a profitable business for those who can make the grade.

Certified seed is used at home and abroad by the larger body of growers who produce high quality potatoes for the table stock markets. It is neither wise nor desirable for most table stock growers to attempt to produce their own seed. Certain diseases multiply rapidly in the crop during the growing season, causing degeneration which affects the yielding qualities of the tubers. Good seed is necessary for good crops.

The seed grower's job is to plant approved foundation seed, well isolated from other potatoes ; pull out all virus-diseased and abnormal, weak plants, as they may appear in the field ; control other diseases and insect pests by a proper spraying or dusting program ; and finally harvest, store, grade and pack the seed, carefully keeping it identified and well separated from other potatoes. For such seed, official tags are issued to identify the potatoes as suitable for seed purposes. Naturally this seed must come from a better than average crop, for it is expected to produce a better than average table potato crop the following year.

For further information on how to produce certified seed potatoes, growers should consult the Department of Agriculture, Ottawa, or the local District Seed Potato Inspector.—*Department of Agriculture, Canada.*

What the Scientists are doing

PROGRESS IN BOTANY

THE presidential address in the section of Botany of the Indian Science Congress which met in January 1944 at Delhi was given by Dr T. S. Sabnis, the main theme being the recent progress in the various fields of botany with special reference to economic plants.

During the last three or four generations the progress made in improving the numerous plants and animals which provide us with food, clothing and ornament has been astounding. The progress achieved by the non-scientific methods in earlier centuries was no doubt good, but it could hardly have stood the strain of modern political problems and helped to satisfy the industrial and commercial requirements of today.

The world was first made alive to the possibilities of the science of plant breeding by the work of Luther Burbank in the last decades of the last century. Since 1900, however, a fresh impetus has been given to researches on most of the cultivated plants all over the world. Whereas results of great economic importance were secured with wheat in America, England and India, and advances made in several other crops also, the work led to important findings of scientific interest as well.

Intensive work with selection and cross fertilization of indigenous material was followed by exploration of usual material in different parts of the world and new forms, possessing great resistance to diseases, frost and drought were introduced, specially in Russia and the United States of America. Along with the introduction of new plants has been going on the work of changing the existing forms by means of X-rays and ultra-violet rays.

Controlled illumination

Another development of botany has been plant ecology, that is, that branch of botany which deals with the effects of various environmental factors upon plants. In dealing with the problem of controlling vegetation, either for agriculture, forestry or for the improvement of grassland, plant ecology, by investigating the fundamental laws concerning growth of plants in relation to the environmental factors, will be of much help.

Much attention has lately been paid to one of these factors, viz. light. By subjecting plants to controlled illumination, and sometimes, when necessary, by artificially giving them additional illumination, the growth periods of crops have been markedly changed, thus making possible certain breeding experiments. Besides, the information secured is, useful to the agriculturist and the horticulturist in their attempts to grow plants in new environments, different from those to which the plants belong.

The study of response of plants to different temperatures has led to the process, originated by Russian scientists and now known as vernalization, which consists of giving to the seeds certain temperature treatments. Vernalization has enabled Russia to grow luxuriant crops of winter wheat in areas in which it was formerly impossible to grow it successfully. Thus the process has enabled agriculturists to triumph over nature's climatic barriers. A good deal of work in this direction is now being done in different countries.

Another factor which stimulates plant growth resides in the plant itself and was discovered only recently. It is known as the growth regulator and is something like the growth hormones in the animals. Preparations of plant growth regulators are now being used for stimulating the rooting of plant cuttings or seedlings which were normally found difficult to be propagated.

Researches on the nutrition of plants have led to the discovery of the important role some of the elements play in the life of most plants. These elements are required only in traces, yet they are essential. Their deficiency was at times responsible for failure of vast crops, but with the knowledge now gained the crops can be saved by supplying the elements.

Other important researches to increase the production of economic plants are those which deal with plant-diseases. Much has been done in this direction by breeding resistant varieties of plants.

In short, the work of the botanists in widening the geographical range of crops, discovering new and suitable varieties, studying their relation to soil, temperature, light and moisture, improving their yields, reducing the cost of cultivation, securing immunity from diseases—all this work has, during the last few decades, been a remarkable record of progress.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. How is one to differentiate a male lac cell from a female ?

A. The male and female lac larvae are extremely similar and can be differentiated only by experienced lac experts under high magnification. But the lac cells (coat) produced by male and female larvae differ in shape and can be easily distinguished with the naked eye after about four weeks in the *Katki*, *Aghani* and *Jethwi* crop and about 12 weeks in the *Baisakhi* in northern India.

The male cell is elongate, roughly cigar-shaped and the female more or less oval or round in shape.

Q. Do the male and female lac insects produce equal quantities of lac and have equal span of life ?

A. The male and female larvae take the same time to develop into a male and female insect; about 6 to 8 weeks in the *Katki*, *Aghani* and *Jethwi* crops and about 14 to 16 weeks in the *Baisakhi* crop in northern India. But at this stage the male insect comes out of its lac coat and ceases to produce any more lac. It walks over the lac encrustation and goes on mating, without feeding, with one female after another for about four days and then dies. Up to this time both the male and female insect produce very little lac. Hereafter it is the females that live on the tree and produce the entire lac crop.

Broadly speaking, the male lac insect from larva to adult lives for about two months in the *Baisakhi* crop and the female insect from larva to adult lives for about four months in the *Katki*, six months in *Aghani* and *Jethwi* and eight months in the *Baisakhi* crop.

Q. (a) What can be the approximate cost of installing a cold storage plant on a modest scale ?

(b) Which firm in India can supply the plant ?

(c) Please suggest some literature on this subject, which can give some technical information.

(d) Where can the working of such a plant be personally seen ?

A. (a) The approximate cost of installing a cold storage plant on a modest scale (i.e. for a room of 15 ft. × 20 ft. × 10 ft. dimensions) would be as under :

(i) Rs. 8,000 for machinery,

(ii) Rs. 6,000 for cork to provide an insulating material. Total Rs. 14,000.

(N.B. The cost is exclusive of the building.)

(b) Messrs Volkart Brothers, Lahore, undertake to supply and instal such a plant.

(c) Technical literature on the subject can be had from the above firm.

(d) Working of a small experimental unit can be seen at Lyallpur. Commercial cold storage plants can be seen at Sialkot (Rai's Cold Storage, Sialkot) and Jammu (Potato Seed Cold Storage, Jammu).

NO food possesses all of the four essential vitamins, A, B, C, and D, but eggs contain three of them—A and D, the growth vitamins in abundance, and B, the yeast vitamin, in moderate quantities.

What's doing in All-India

BOMBAY

By S. R. Chadha, B.Sc., M.R.C.V.S.
Assistant Director of Veterinary Services

CIVIL Veterinary Department, Bombay, was called upon to assist in the cattle relief work during the last famine in Bijapur district. The cattle relief work having been taken up by the Bombay Humanitarian League, on behalf of the Bijapur District Famine Relief Committee, all veterinary assistant surgeons in the district and newly-appointed veterinary inspectors on special duty were instructed to give all possible help to the Committee. As the Committee had started cattle camps, mass feeding centres, cheap food depots and plough centres, all the veterinary staff in the district was required to visit these places.

The Divisional Veterinary Officer, southern division was also instructed to pay special attention to this work and visit the famine area as frequently as possible. The Director of Veterinary Services himself proceeded to the spot and convened a meeting of the subordinate staff put on this job and gave necessary instructions and advice on how to deal with the situation. The veterinary inspector on special duty was constantly on tour visiting the various relief centres and advised people concerned. At the same time he supervized the work of the veterinary assistant surgeons who were regularly visiting weekly cattle markets to advise on the purchase of useful cattle, to detect contagious diseases and to carry out timely control measures. They also visited cattle camps, mass feeding centres and ploughing centres, rendering professional assistance and also advising owners and people in-charge on maintaining cattle in health under famine conditions. And all this was very much appreciated by the Committee. Work being very heavy the wholesale immunization of cattle in the district against various contagious diseases, previously planned was not carried out and control measures were adopted during the various outbreaks wherever they occurred, by carrying out curative and prophylactic measures in the affected and surrounding villages, respectively.

It is gratifying to note that the timely aid rendered by the Veterinary Department proved very helpful in minimizing the losses in cattle on account of diseases.

In all 3,838 animals were protected against black quarter, 5,847 against haemorrhagic septicaemia and 23,958 against rinderpest during the famine period.

Owing to the widespread nature of the outbreak of rinderpest in the south of the province and the difficulty of getting virus in the villages in time from the Bombay Veterinary College in Bombay a sub-depot was opened in Dharwar. In this way it was possible to ensure early delivery of fresh virus in the field and with satisfactory results.

CATTLE FAIRS OF TRICHINOPOLY AND TANJORE

By T. A. Vishwanatha Ayyar
District Veterinary Officer, Trichinopoly

THE Tanjore district is the chief deltaic area in the southern part of the province. Tanjore being the headquarters in the modern administration and that of the Chola kings in the ancient scheme of administration.

Cauvery, the chief river of the district passes near Kumbakonam, a town some miles away from Tanjore. The alluvial soil deposited by this river on its bank is supposed to be very much conducive to the fertility of the soil, and its waters to the development of the intellect of its consumers.

The number of *Saivite* and *Vaishnavite* temples in Kumbakonam, its situation on the banks of Cauvery, its religious importance as the head-quarters of His Holiness the Jagat Guru Sri Sankaracharya of Kamakoti Peetam, its importance as the centre of Vedic culture in the twin branches of classical Sanskrit and ancient Tamil literature represented in the holy persons of Sri Sankara, and the Matathipadhis of Tiruppanandal, Aduthurai and Dharapuram have made Kumbakonam the chief centre of attraction in the district.

The sacredness of the place can be gauged by the popular belief that the worst sinners are absolved of their sins by a mere visit to the place, not to speak of the supposed result after a bath in one of the ghats of the river and the Mahamakam tank and visit to the shrines. On the Masi Maham day, the day sacred to Lord Pasupathi, starts the cattle fair at Neerathanallur, six miles north of Kumbakonam. Thousands of people from all over the southern districts visit this place, during this period, for a holy dip in the Mahamakam tank, where seven celestial waters are believed to spring up and flood the same.

The historical background of the fair dates back to ancient times. In old days, means of communications were mainly through country tracts in bullock carts. When people from various districts met, they had occasions to compare notes regarding their cattle. Exchange of cattle used to take place in a formal manner. From this idea of exchange of cattle has developed the practice of using these festive occasions for the exchange of old animals and the purchase of new ones. In course of time this further developed into organized fairs and shows. In South Indian districts particularly, it will be seen that the holding of these fairs usually synchronizes with religious festivals like Sivarathri and Maham.

Neerathanallur fair

Neerathanallur fair has been conducted for very many years, during the tamil month of Masi (March–April), when the Masi Maham festival is celebrated at Kumbakonam. Some years back, the fair used to be conducted for about a month beginning a week or 10 days before the Maham festival, and ending about two weeks after the close of the festival. For the last two or three years, however, it lasts only for about three weeks. The fair is conducted at Neerathanallur about half-a-mile from the Coleroon river. The cattle fair ground has an area of about 16 acres and is situated about six miles north of Kumbakonam. There is a metalled road from Kumbakonam to this place and special buses are run during the period of fair between Kumbakonam and this place.

In spite of the proximity of the fair grounds to the river Coleroon, a number of tube-wells have been temporarily sunk, besides one permanent bore-well and two draw-wells. Elaborate sanitary and lighting arrangements are made by the staff of the Public Health Department, and financed by the District Board. After the abolition of the Taluk Boards in 1934, the fair is being conducted by the Tanjore District Board. This is the most important annual cattle fair in the district supplying the public with the Mysore breeds of animals—Hallikars, Alambadi and Amrit Mahal, etc. The chief breeds of cattle that are brought to the fair are :

Amrit Mahal, Alambadi and Hallikar	About 10 per cent
Manapari ..	„ 30 „ „
Kangayam and its cross ..	„ 5 „ „
Indigenous— Local Tanjore, Trichinopoly and South Arcot	„ 55 „ „

The Manapari breed of cattle are fairly good type of animals both from the point of average working capacity and also from the point of milk production when compared with the other cattle.

These animals have short symmetrical horns slightly curved inwards and are more often grey in colour, a few of tan colour. The body is well developed with a short head more often dark eyes and tail reaching just above hock. These animals form a class by themselves. This breed is the result of cross-breeding between Kangayam bulls and local cows.

The ryots of the district and people from Trichinopoly and South Arcot avail themselves of the advantages of this fair for their annual purchase and exchange of cattle. About 11,655 animals were exhibited and 10,176 were sold during the fair held in March 1942.

Agricological exhibition

An agricultural and veterinary exhibition is held on the fair grounds. Separate sheds are put up by the District Board for this purpose. A cattle show in which different breeds of cattle

What's doing in All-India

BOMBAY

By S. R. Chadha, B.Sc., M.R.C.V.S.
Assistant Director of Veterinary Services

CIVIL Veterinary Department, Bombay, was called upon to assist in the cattle relief work during the last famine in Bijapur district. The cattle relief work having been taken up by the Bombay Humanitarian League, on behalf of the Bijapur District Famine Relief Committee, all veterinary assistant surgeons in the district and newly-appointed veterinary inspectors on special duty were instructed to give all possible help to the Committee. As the Committee had started cattle camps, mass feeding centres, cheap food depots and plough centres, all the veterinary staff in the district was required to visit these places.

The Divisional Veterinary Officer, southern division was also instructed to pay special attention to this work and visit the famine area as frequently as possible. The Director of Veterinary Services himself proceeded to the spot and convened a meeting of the subordinate staff put on this job and gave necessary instructions and advice on how to deal with the situation. The veterinary inspector on special duty was constantly on tour visiting the various relief centres and advised people concerned. At the same time he supervized the work of the veterinary assistant surgeons who were regularly visiting weekly cattle markets to advise on the purchase of useful cattle, to detect contagious diseases and to carry out timely control measures. They also visited cattle camps, mass feeding centres and ploughing centres, rendering professional assistance and also advising owners and people in-charge on maintaining cattle in health under famine conditions. And all this was very much appreciated by the Committee. Work being very heavy the wholesale immunization of cattle in the district against various contagious diseases, previously planned was not carried out and control measures were adopted during the various outbreaks whereever they occurred, by carrying out curative and prophylactic measures in the affected and surrounding villages, respectively.

It is gratifying to note that the timely aid rendered by the Veterinary Department proved very helpful in minimizing the losses in cattle on account of diseases.

In all 3,838 animals were protected against black quarter, 5,847 against haemorrhagic septicaemia and 23,958 against rinderpest during the famine period.

Owing to the widespread nature of the outbreak of rinderpest in the south of the province and the difficulty of getting virus in the villages in time from the Bombay Veterinary College in Bombay a sub-depot was opened in Dharwar. In this way it was possible to ensure early delivery of fresh virus in the field and with satisfactory results.

CATTLE FAIRS OF TRICHINOPOLY AND TANJORE

By T. A. Vishwanatha Ayyar
District Veterinary Officer, Trichinopoly

THE Tanjore district is the chief deltaic area in the southern part of the province. Tanjore being the headquarters in the modern administration and that of the Chola kings in the ancient scheme of administration.

Cauvery, the chief river of the district passes near Kumbakonam, a town some miles away from Tanjore. The alluvial soil deposited by this river on its bank is supposed to be very much conducive to the fertility of the soil, and its waters to the development of the intellect of its consumers.

The number of *Saivite* and *Vaishnavite* temples in Kumbakonam, its situation on the banks of Cauvery, its religious importance as the headquarters of His Holiness the Jagat Guru Sri Sankaracharya of Kamakoti Peetam, its importance as the centre of Vedic culture in the twin branches of classical Sanskrit and ancient Tamil literature represented in the holy persons of Sri Sankara, and the Matathipadhis of Tiruppanandal, Aduthurai and Dharapuram have made Kumbakonam the chief centre of attraction in the district.

The sacredness of the place can be gauged by the popular belief that the worst sinners are absolved of their sins by a mere visit to the place, not to speak of the supposed result after a bath in one of the ghats of the river and the Mahamakam tank and visit to the shrines. On the Masi Maham day, the day sacred to Lord Pasupathi, starts the cattle fair at Neerathanallur, six miles north of Kumbakonam. Thousands of people from all over the southern districts visit this place, during this period, for a holy dip in the Mahamakam tank, where seven celestial waters are believed to spring up and flood the same.

The historical background of the fair dates back to ancient times. In old days, means of communications were mainly through country tracts in bullock carts. When people from various districts met, they had occasions to compare notes regarding their cattle. Exchange of cattle used to take place in a formal manner. From this idea of exchange of cattle has developed the practice of using these festive occasions for the exchange of old animals and the purchase of new ones. In course of time this further developed into organized fairs and shows. In South Indian districts particularly, it will be seen that the holding of these fairs usually synchronizes with religious festivals like Sivarathri and Maham.

Neerathanallur fair

Neerathanallur fair has been conducted for very many years, during the tamil month of Masi (March–April), when the Masi Maham festival is celebrated at Kumbakonam. Some years back, the fair used to be conducted for about a month beginning a week or 10 days before the Maham festival, and ending about two weeks after the close of the festival. For the last two or three years, however, it lasts only for about three weeks. The fair is conducted at Neerathanallur about half-a-mile from the Coleroon river. The cattle fair ground has an area of about 16 acres and is situated about six miles north of Kumbakonam. There is a metalled road from Kumbakonam to this place and special buses are run during the period of fair between Kumbakonam and this place.

In spite of the proximity of the fair grounds to the river Coleroon, a number of tube-wells have been temporarily sunk, besides one permanent bore-well and two draw-wells. Elaborate sanitary and lighting arrangements are made by the staff of the Public Health Department, and financed by the District Board. After the abolition of the Taluk Boards in 1934, the fair is being conducted by the Tanjore District Board. This is the most important annual cattle fair in the district supplying the public with the Mysore breeds of animals—Hallikars, Alambadi and Amrit Mahal, etc. The chief breeds of cattle that are brought to the fair are :

Amrit Mahal, Alambadi and Hallikar	About 10 per cent
Manapari ..	" 30 " "
Kangayam and its cross ..	" 5 " "
Indigenous—Local Tanjore, Trichinopoly and South Arcot	" 55 " "

The Manapari breed of cattle are fairly good type of animals both from the point of average working capacity and also from the point of milk production when compared with the other cattle.

These animals have short symmetrical horns slightly curved inwards and are more often grey in colour, a few of tan colour. The body is well developed with a short head more often dark eyes and tail reaching just above hock. These animals form a class by themselves. This breed is the result of cross-breeding between Kangayam bulls and local cows.

The ryots of the district and people from Trichinopoly and South Arcot avail themselves of the advantages of this fair for their annual purchase and exchange of cattle. About 11,655 animals were exhibited and 10,176 were sold during the fair held in March 1942.

Agricological exhibition

An agricultural and veterinary exhibition is held on the fair grounds. Separate sheds are put up by the District Board for this purpose. A cattle show in which different breeds of cattle

are judged and prizes given is another feature of this fair. The *mirasdars* of this district take a keen interest in the show and award a number of cups and medals. Usually the Sub-Collector of the division presides over the function and distributes the prizes. The Veterinary Department carries on propaganda, delivers lectures on animal husbandry with the aid of a magic lantern, controls the health of the cattle during the period, enforces the Cattle Disease Act, whenever necessary and mainly conducts the show and fair with the help of the agricultural and veterinary officers of the district.

ORISSA

By R. L. Kaura, B.V.Sc., M.R.C.V.S.
Deputy Director of Veterinary Services, Orissa

UNDER the distinguished patronage of His Excellency Sir William Hawthorne Lewis, K.C.S.I., K.C.I.E., J.P., I.C.S., Governor of Orissa and the presidentship of Hon'ble Pandit Godavaris Misra, M.A., Minister for Development, Finance, Publicity and Education, the Orissa Provincial Cattle Show Society organized its first show in the Quilla Maidan at Cuttack from 17 to 19 December 1943.

On the 17th morning His Excellency, the Governor of Orissa and Lady Lewis arrived at the show ground at 10 a.m. and after the performance of the opening ceremony of the show, were taken round the various departmental and private demonstration and industrial stalls and the livestock exhibits in which Their Excellencies evinced keen interest. Thereafter His Excellency presided over the fifth annual general meeting of the *Utkal Go-mangal Samiti*.

Governor's speech

The speech delivered by His Excellency in inaugurating the show is reproduced below:

'Pandit Godavaris Misra, ladies and gentlemen: It has been a special pleasure to my wife and myself to come here this morning to see the first provincial cattle show and to attend this annual meeting of the *Utkal Go-mangal Samiti*. We hope that the cattle show I have just inaugurated begins a new era for improvement of our cattle in Orissa and we look forward to an even better and bigger show next year. Cattle shows provide not only interest and entertainment, but also instruction. There is a great deal for all of us to learn about India's herds and strains of cattle and buffaloes which are one of its most important assets. The work that has been put into the organization of this show and your attendance today is recognition of the part that cattle and other animals already play in the economic life of the province. But the purpose behind the show is to stimulate existing interest and to engender competition with a view to our animal husbandry becoming the basis of the agricultural prosperity which should be one of our foremost aims when we come to consider the shape which our post-war reconstruction is to take. This is an agricultural province and our prospects of improving the living standards and health of the mass of the population depend on the production of larger and better crops and of more milk. We must have strong bullocks and good cows. We can achieve this by introducing good strains of dual purpose breeds from those parts of India which are ahead of us in this respect. The *Samiti* have with Government help arranged for Hariana bulls and in many parts of Orissa their value is already recognized. But if we are to achieve within a reasonable period of planning the desired revolution, our progress must be immeasurably faster and we will have to make up our minds to undertake a very extensive campaign of persuasion and propaganda in every village and every home.

Need for better cattle

'Our farmers must be shown that better cattle are a paying proposition and they should be taught to be satisfied with nothing less than the best. Once they learn that good animals give them returns in terms of work and health, they will insist on them and half of our problem will be solved. So I take this opportunity of appealing for your fullest cooperation and help.

I ask that those of you who can afford to maintain bulls will do so for the benefit of your own herds and those of your poorer neighbours. It will be an extremely good investment for yourselves and for the province. Simultaneously an earnest attempt should be made to eliminate the scrub bulls which are one of the principal factors in the deterioration of our herds. In one area near Jajpur this is being done on a mass scale, and I congratulate those concerned. But I do feel that we have a duty to support an organization which was set up to carry out objects which we all agree are absolutely vital to our future. I hope therefore that from this cattle show and this gathering will emerge a new determination combined with a pledge to do all in your power to improve cattle in Orissa. This will include the hard work that is required to improve grazing facilities and fodder crops. I fear it is often true that some of the worst land in a village is reserved for grazing and that it is not sufficiently realized that if the quality and quantity of milk is to be increased the cows must be given something more than they can pick up on untended pasture. The *Samiti* and the provincial Veterinary Department have made a start on a small scale and the resources and advice of the Agricultural Department are at our disposal. I shall watch with interest and sympathy future developments in this connection.

'Before I close I must thank on your behalf the committee who have organized the cattle show and those who have presented cups and prizes. I would thank also the office bearers and Committee members of the *Go-mangal Samiti*.'

Livestock entries

There were 273 entries which included Hariana, graded, indigenous and *goshala* cattle; Murrah and graded buffaloes; Bikaneri, graded and indigenous sheep; Ganjam and Black Bengal types of goats and Rhode Island Red, White Leghorn, *desi* and cross-bred fowls. Indigenous buffaloes from the coastal tracts could not be exhibited at the show as they are generally kept in a semi-wild state and from other tracts for want of adequate transport facilities in these days. All the exhibits were fed for the duration of the show at the cost of the Show Society. All the districts with the exception of Koraput and Sambalpur which are situated at a greater distance from Cuttack, sent their exhibits to the show. It is hoped that in future when the railway transport facilities become normal livestock from all parts of the province will be properly represented.

Judging

A panel of judges was appointed by the Executive Committee and for judging each class of exhibits at least three of them were selected. Cattle and buffaloes were judged on the afternoon of the 17th and the next morning, poultry on the 18th afternoon and sheep and goats on the 19th morning. Milking competition which proved to be an attractive feature of the show was arranged separately for cows and buffaloes commencing on the afternoon of the 17th and ending on the following afternoon, taking three milkings of which the first one was not taken into account. The departmental and private demonstration and industrial stalls were judged on the 19th morning. On the 19th afternoon when Their Excellencies were also present 'the best animal in the show' and 'the best bird in the show' were judged, for which His Excellency the Governor of Orissa and Lady Lewis have kindly donated a Supreme Championship Cup each respectively.

Educational value

The show which is the first of its kind in Orissa is a landmark in the history of animal husbandry in the province. The livestock exhibits and the stalls set up by the Civil Veterinary Department to demonstrate scientific methods of breeding, feeding, management and control of diseases and pests of livestock and the stalls exhibiting livestock industries, e.g. dairying, poultry, wool, hides and skins, fisheries, etc. proved to be of great educational value to all the breeders and lovers of livestock who had come from various parts of the province to attend the show. The stalls set up by the agriculture, industries, marketing, public health, grow more food, national war front and other departments and the S.P.C.A. also greatly interested the visitors. It is hoped that the knowledge, the inspiration and the encouragement provided by the show ground and the judging rings and the enthusiasm and the competitive spirit generated by handsome prizes and trophies will stimulate the production of better livestock in the province and people will carry the new ideas to their villages not only for their own benefit but also for that of their illiterate brethren.

Sports

An interesting programme of sports consisting of hackney and private four-wheeled carriage races, stone dragging competition (bullocks), children and adults' pony races, horse-jumping, tent pegging, bullock-cart race and donkey race, was arranged in aid of the Orissa War Fund and the Orissa Relief Fund on the final day of the show in the afternoon just before the prize distribution. It provided a good deal of entertainment for the visitors and created in them enthusiasm and interest for good animals for sport as well as for transport. The attendance was very large and a good collection was made for the above funds. At times musical entertainment was also provided by the loud-speaker so kindly lent by the Publicity Department.

Prize distribution

Her Excellency Lady Lewis kindly gave away the prizes. Besides 29 challenge and three other cups for different classes of exhibits, Rs. 1310-8 in the form of cash prizes, of which a sum of Rs. 510 was kindly contributed by the All-India Cattle Show Society, were awarded to the winners. Every winner of a prize excepting for the sports items, was also awarded a certificate of merit by the Orissa Provincial Cattle Show Society or the All-India Cattle Show Society as the case might be. The award of cash prizes was limited to private breeders only. His Excellency the Governor of Orissa's Supreme Championship Cup for the best animal in the show was awarded to Sri Chakradhar Misra of Cuttack, the owner of the best Hariana cow in the show. Her Excellency Lady Lewis Supreme Championship Cup for the best bird in the show was awarded to Mr B. Nayak of Cuttack, the owner of the best Rhode Island Red cock in the show. Photographs of some of the other prize winners are also given.

PADDY CULTIVATION IN COCHIN

By C. S. Venkatachalam

Entomologist, Government Central Farm, Trichur, Cochin

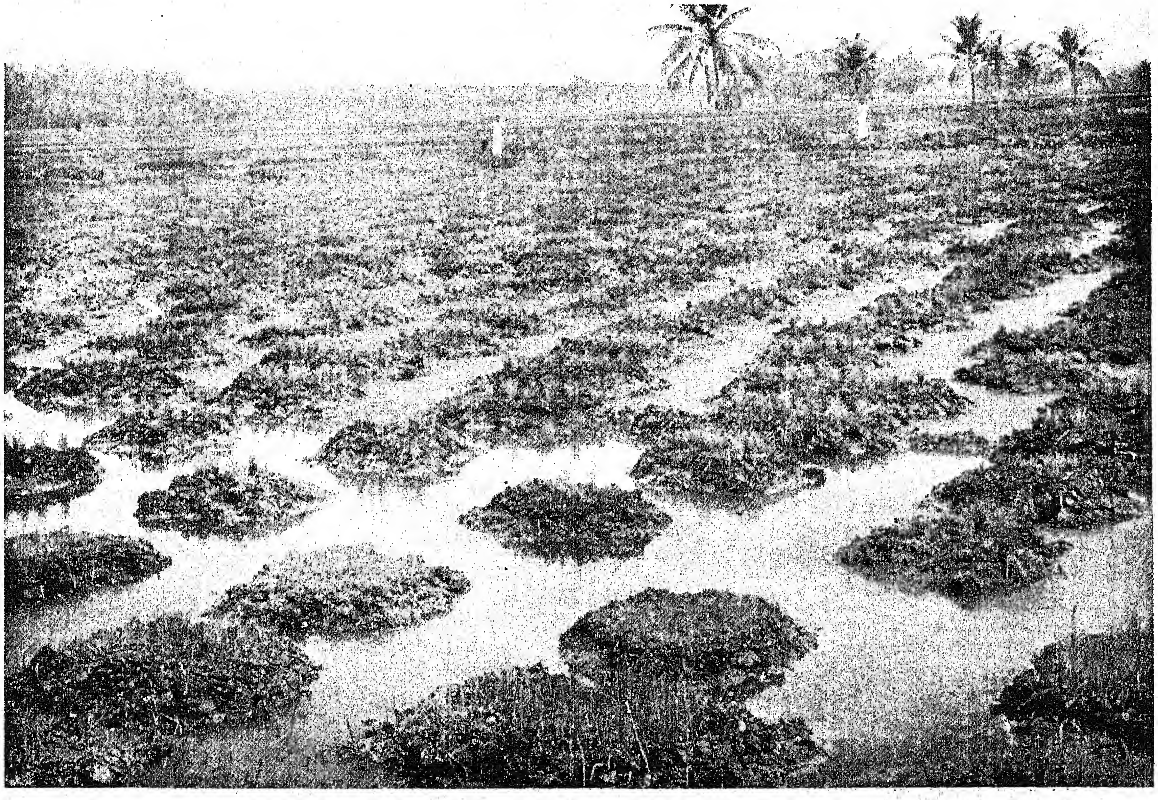
PADDY, the staple crop of the State is grown throughout the year. The first crop known as *viruppu* is generally broadcast in April-May with the first showers of the south-west monsoon and harvested in August-September. It is purely a rain-fed crop. *Mundakan*, the second crop, is transplanted in August-September and harvested in December. This crop depends for its success on the north-east monsoon and any irrigation facilities available. The third crop which is taken from January to April-May is called *punja*. This is either broadcast or transplanted and depends entirely on irrigation facilities. There are lands in which all the three crops are grown during the course of one year. A large area is under *viruppu* as well as *mundakan* and of the total wet lands about 86,000 acres belong to such double crop paddy land. Single crop *viruppu* land comprises about 1,21,000 acres.

Intensive cultivation

Every possible site is exploited to grow paddy. The slopes of hills, wherever possible, are cultivated with hill varieties of paddy. *Kole* lands are extensive lakes which are drained by engine-pumps during the hot months and utilized for the cultivation of short-term varieties of paddy and about 18,000 acres of such land are cultivated every year. The low-lying swamps adjoining backwaters, subject to floods during monsoon months, and to tides from the sea are important paddy lands of the southern parts of the State.

The State's production of paddy however does not suffice to feed her population of about 14 lakhs for more than nine months in the year. But this shortage was no matter of concern in normal times as imports of rice and paddy from Burma were ample and assured. With the sudden and unexpected exclusion of Burma rice the paddy situation became alarming, and the Government and the people have with characteristic energy set about to counter it. Intensive efforts are already in full swing to stimulate production. Large areas of forests have been cleared and put under cultivation of paddy under a special officer called Hill Paddy Superintendent. A comprehensive programme of assistance to farmers to expand production

Preparation of mounds for *koothumundaken* paddy



The seedlings growing on mounds (Note the water between them)

PLATE 24

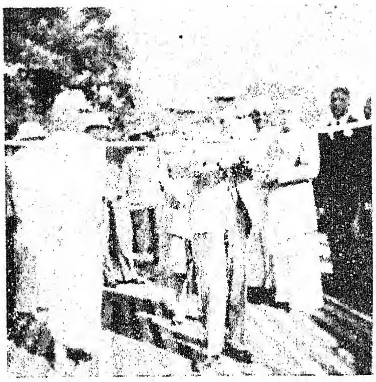


FIG. 1. Opening ceremony of the show by H. E. the Governor of Orissa.

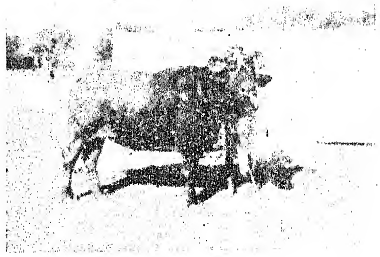


FIG. 2. The best Murrah bull in the show.

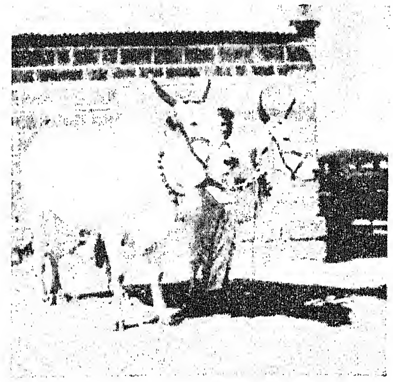


FIG. 3. The best pair of bullocks in the show.

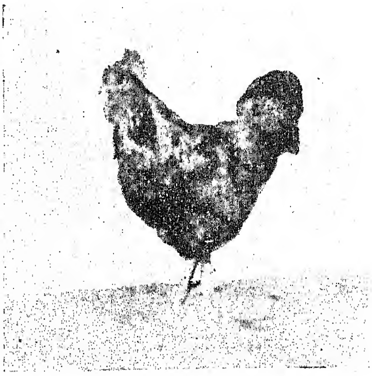


FIG. 4. The best bird in the show: Cock.

FIG. 5. The best Bikaneri ram in the show.

FIG. 6. The best Ganjam type buck in the show.

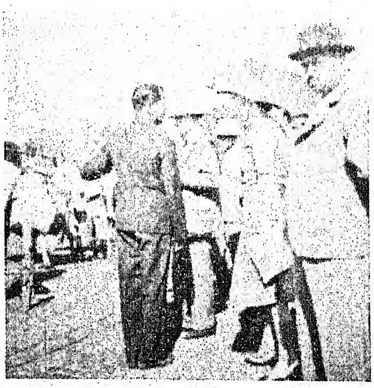


FIG. 7. Their Excellencies interested in a Hariana cow.

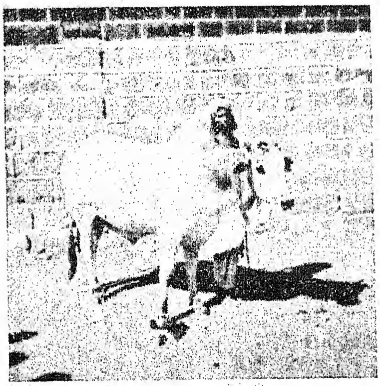


FIG. 8. The best graded progeny of *Samiti's* Hariana bulls.

FIG. 9. His Excellency in the Agricultural stall.

in all directions is in active working. Manure depots have been opened to serve every nook and corner of the State and facilities for grants of loans of seeds, manures and implements have been widely extended. Free and unlimited supply of green manures from the forests has been provided. Irrigation facilities are exploited to the utmost. Even small measures of obtaining additional production from the land such as *koottumundakan* cultivation of paddy, which is the main subject matter of this article, are also actively encouraged.

Koottumundakan paddy

Koottumundakan literally means the combining of the cultivation of *mundakan* paddy with *viruppu*. This system of cultivation has been in vogue in the State for a very long time, generally in the swamp paddy lands referred to above. The soil of these lands becomes very saline during the dry months owing to sea tides and consists of deep sticky clay. Although the varieties cultivated in these localities can tolerate a certain amount of salt, the success of the crops depends to a larger extent on heavy rainfall which washes off the salinity and compensates for the effects of the sea tides. The lands being low-lying and easily flooded cannot be drained after the *viruppu* crop is taken to permit transplantation of the *mundakan* seedlings. Hence it is not possible to cultivate *mundakan* here after the *viruppu* is over as in ordinary paddy lands. Moreover, the swamp lands are surrounded by thickly growing coconut gardens and there is no nursery space to grow the *mundakan* seedlings required for transplantation. The farmer overcomes these difficulties by adopting a method in which *mundakan* and *viruppu* seeds are mixed and sown together.

Preparation of the land for sowing

The cultivation of these lands needs a specialized technique. The fields are worked with a spade possessing a broad and triangular blade and a handle 6 to 8 ft. long. Ploughing with oxen is impossible and the labourers have to work with their feet immersed in mud which in many cases reaches above their knees. The soil is turned into circular mounds of about 4 to 5 ft. in diameter, during the dry months of March and April. The height of the mounds depends upon the degree of salinity which requires washing off, and so they have to be taller in fields of heavier salinities. Ten to fifteen men are required to work one acre of land into mounds. Sowing is carried out towards the end of May or early in June after the initial showers of the south-west monsoon have washed the soil of all salt. The mounds are hoed immediately before sowing to loosen the soil and the seeds deposited on them. The seeds are sprouted before sowing if the mounds are very wet and liable to easy flooding. The varieties of seed used depend upon the nature of the fields and their vicinity to the backwaters.

Chetti viruppu, cheru viruppu, pokkali, aryan, chembikannan are some of the common *viruppu* seeds : while *muthiramundakan, chennali, orpandi* form some of the *mundakan* seeds mixed with the *viruppu*. The *viruppu* seeds are mixed with the *mundakan* seeds in the proportion of five to one by volume, and about 60 to 70 lb. of the mixed seeds are used for sowing an acre.

After-care and harvesting

Grass weeds are not generally severe. Moss which comes along with the high tides gets entangled with the seedlings and mats them. The moss sheets have to be carefully removed by hand to prevent smothering of the plants and this is an arduous task. The plants are about 2 ft. tall by the middle of July when the mounds are broken up and the seedlings distributed uniformly over the entire field. This operation too is mainly carried out by spades. The *viruppu* plants mature and become ready for harvesting towards the end of September. The ear-heads are carefully cut off without injuring the *mundakan* seedlings growing between. After the harvest a plank with spikes is drawn over the field so as to submerge the straw under water and smother it. The *mundakan* seedlings which are also pressed by this operation become erect and continue to grow. In many a field the planking operation is supplemented with trampling of the straw with the feet, in such a manner as to prevent injury to the live seedlings. The *mundakan* crop is ready for harvesting in January, and generally suffers from salinity if the north-east rains are insufficient.

Yield : There are wide variations in the yields from field to field as well as from year to year. Generally it may be stated that about 600 lb. of grain are obtained from the *viruppu* harvest while the *mundakan* crop yields about 600 to 800 lb. The amount of straw obtained from both crops is small since only the top

portions of the plants are harvested.

No manuring is practised in these lands as they are subject to floods, but the soil is rich due to the deposition of silt from the higher regions and to the decay of small organisms brought in with the sea tides. The crops are however manured with beneficial results in fields which are at a distance from the back-waters and protected from salinity by *bunds* and sluices. Flooding also is not very severe in these lands. Rice hispa (*Hispa armigera* O), stem-borer (*Schoenobius incertellus* wlk), leaf roller (*Cnaphaloeroces menoinalis* G) and rice bug (*Leptocorisa acuta* Th) are the common pests in these fields. The *mundakan* crop suffers more from the stem-borer and rice bugs as these pests can breed continuously from one crop to the other.

Originally, the farmer was not bestowing any special attention to this system of cultivation which he was practising as a mere matter of routine. But as the paddy situation has become acute, all care is bestowed on this method of cultivation, and all available land capable of being adapted to such combined cultivation is pressed into service.

MILK RECORDING NEWS

RECORDS of lactations completed during February 1944 have been received from three village milk recording centres. Twenty Hariana cows completed their lactations at Beri averaging 2,891 lb.; two cows and two buffaloes at Chata, United Provinces averaged 2,298 and 1,858 lb. respectively. There was no lactation completed during the month at Meham centre in the Punjab. Returns were also received from Malir for January 1944 and from Sanand for December 1943 and January 1944. Details are given below.

Hariana cows

Beri area, Rohtak district, Punjab : Twenty cows completed their lactations averaging 2,891 lb. with a maximum of 3,919 lb. and a minimum of 1,805 lb. Selected records are as under :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
DG.192	Hazari S/o Ramdhan	5	12.2.43	365	3919	23
BH.17	Chhattar S/o Dataram	2	11.1.43	404	3555	19
DL.267	Bhartu S/o Raja	4	5.6.43	244	3049	23
LK.1	Bagru S/o Mukha	5	28.6.43	238	3276	20
KM.323	Ramsarup S/o Chaina	5	25.4.43	291	3040	15
SR.9	Ransingh S/o Ramsarup	2	15.2.43	322	3213	21
GH.11	Abhey S/o Jawahra	7	25.2.43	324	2912	19

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Milk yield lb.	Maximum daily recorded yield lb.
SR.1	Chandram S/o Harisingh	2	21.4.43	300	3560	17
M.L.2	Giani S/o Kishanshai	4	14.4.43	289	3726	23

Local cattle and buffaloes

Muttra district, United Provinces. Two cows and two buffaloes completed their lactations during February 1944. Their records are given below :

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Milk yield lb.	Maximum daily recorded yield lb.
273	Cow Siriya	1	7.3.43	335	2137	9
153	„ Doongersingh	2	1.4.43	312	2460	8
—	Buff Gayasia	3	27.7.43	211	2550	14
8	„ Buddhi	1	20.9.43	144	1166	12

Murrah buffaloes

Meham area, Rohtak district, Punjab : None of the buffaloes completed a lactation under record during the month.

Sindhi

Malir area, Sind : One cow completed her lactation under record during January 1944, yielding 4,303 lb. in 331 days. Her maximum daily yield was 19 lb.

Kankrej

Sanand area, Ahmedabad district, Bombay: Six animals completed their lactations during December 1943 and January 1944 averaging 2,260 lb. The maximum yield was 2,449 lb. and minimum 1,762 lb. Selected records are as under:

Name of cow	Name of owner	No. of lactation completed	Date of calving	Days in milk	Milk yield lb.	Maximum daily recorded yield lb.
Haren	Rabari Gastan Shedha	1	1.5.43	257	2449	12¾

Brand No.	Name of owner	No. of lactation completed	Date of calving	Days in milk	Milk yield lb.	Maximum daily recorded yield lb.
Bizori	Rabari Vershi Bhata	3	14.4.43	274	2346	13½
Dhoyadi	Rabari Velsi Govind	3	20.5.43	236	2399	14½
Shangodi	Rabari Romashi Bhala	1	10.5.43	244	1762	7¾
Batar	Rabari Valji Govind	3	10.5.43	223	2295	15¼
Muzi	Rabari Khegar Aju	1	15.4.43	252	2310	11¾

CORRIGENDUM

Indian Farming, Vol. V, No. 1, p. 32. Under the heading, 'What's doing in All-India'—MADRAS, *for* 'By Sri T. Vinayaka Mudaliar, G.M.V.C.' *read* 'By Sri K. V. Raghavachari, G.M.V.C.'

The Month's Clip

AN EXPERIMENT IN AGRICULTURAL EDUCATION

By W. A. Stewart

Northamptonshire Institute of Agriculture, Moulton, Northants

OVER a period of six months beginning in December, 1941, the *Farmers' Weekly* conducted a children's competition in farming subjects, and offered by way of award the somewhat unconventional prize of a holiday course at an agricultural institute. Of the 420 competitors who took part, the top sixteen, consisting of nine boys and seven girls aged from 12 to 16 were, by arrangement, given a residential course at the Northamptonshire Institute of Agriculture, Moulton, for some three weeks in September.

This course, which was the first of its kind, was regarded as something of an experiment, and much thought and discussion were given to the drafting of a programme. However, the programme was left flexible, and after the first day or so the children themselves helped to shape it. One idea in the minds of those promoting the course was that in addition to some actual technical instruction, the children should be brought directly into contact not only with those engaged in running the Institute and the Institute's farms, but also with notable farmers in the district, and others interested in agriculture and the countryside.

Syllabus

By the children's unanimous choice, the day's work began at 6.30 a.m. with what were called 'duties'. This meant practical work in the cowshed, or in feeding and tending the pigs, poultry and other livestock, or in the carpenter's shop. After breakfast there was usually an informal talk and discussion, followed by an outdoor class. On most afternoons the children took part in various jobs on the farm, such as milking, harvesting, tractor-driving, stock-judging, etc. and time was also found for practical demonstrations by the Institute's Veterinary Officer in the diagnosis and first-aid treatment of some of the commoner animal diseases, and for demonstrations in the dairy on butter and cheese-making. On other afternoons visits were made to farms in the country. In the evenings there were more talks, given usually by visitors, discussions, debates, film shows, and other recreational activities.

The syllabus may have seemed formidable, some might say, too formidable for children of 12 to 16 years old, to tackle adequately in a period of rather less than three weeks, but the truth is that the children showed an almost insatiable appetite for opportunities of doing things, for gathering information and for arguments on what they had done, heard and seen.

Every effort was made to link the talks in the classroom with what the children saw on the Institute farms, and on the other farms which they visited. After the first few days most of the important points came out by way of question and answer, and it was clear that the children learned to observe for themselves. Amongst other things they learned quickly to identify grasses and other plants. They soon appreciated that a group of four Ayrshire cows could vary substantially from the correct conventional form, and it is pretty certain that when they see cows in future they will almost unconsciously appraise the shape of the udder, and notice the presence or absence of indications of health and other points of economic value.

They learned a great deal from talks given by Mr H. R. Overman, the Chairman of the County War Agricultural Executive Committee, Mr C. E. Harvey, Chairman of the Milk Production Sub-Committee of the War Agricultural Executive Committee, Dr Fisher, the Headmaster of Oundle School, Mr George Dallas, Mrs Frances Donaldson, and others. Both Mr Overman and Mr Harvey talked to them as if they were farmers, and the children responded well and argued forcefully on such questions as land nationalization and large versus small-scale farming. Dr Fisher spoke of the importance in education of the eye and the hand, and advised the children to cultivate as fully as possible the exact observation of natural things.

As regards the actual instruction, we found that the children were particularly interested, amongst other things, in the history of the breeds and the application of mendelism to stock-breeding, in the feeding of livestock, in soils (linked up with soil tests in the laboratory), and in a talk on marketing followed by a visit to the local market. A lot of fun was obtained from what we called a 'spotter'. This consisted of some hundred specimens, photographs, etc. laid out in rows. The children moved round the rows, being given just so many seconds to identify and write down what each item was. Incidentally, the results of this test were rather unexpected, as some of the younger children did particularly well.

One Saturday afternoon was spent in demonstrating to the children how to handle cattle and pigs, and how to prepare them for show or sale. This may sound a little remote from ordinary commercial or wartime farming, but no doubt there will be shows again after the war, and there are still auction sales of breeding stock. In any case pedigree stock-breeding is likely to form an important part of farming policy in post-war years. The children were much interested, and it is as well that they should realize that skill and knowledge are needed for this sort of thing, and that there is much real satisfaction to be derived from being able to 'bring out a beast' looking its best. Incidentally, it is simply one of the many instances in farming where real pleasure can be derived from the work in hand.

Farming and the young

On the last Sunday evening, Mr Malcolm Messer, the Editor of the *Farmer's Weekly*, talked to the children about the structure of farming in its wide ramifications as a part of a vast universe, and the children came to see themselves in true perspective as a few little human beings with a passionate longing to find their right niche in that universe. One of them summed it up with the question, 'Oughtn't something to be done about us ?' What he meant, of course, was, couldn't something be done to help them and all the others like them to find their right niche in life in some work connected with farming ?

If nothing more came out of this experiment, it certainly confirmed Mr Hudson's statement that the younger generation is growing up with a new appreciation of the problems and the importance of the English countryside, and that a new link is being forged between country and town. For only three of the sixteen children at Moulton were the sons or daughters of farmers ; several came from the London suburbs, and one was a lad who had been evacuated from the crowded dock area of Grimsby to a village in Lincolnshire.

The question arises, can the farming industry, or the country as a whole, afford to neglect this very important new reawakening which is so evidently taking place ? There is some vital young blood anxious to find its way into an industry which badly needs it. Unfortunately, 'farming still remains unnecessarily bleak to the youth looking over the gate', but the obstacles in the way of recruiting fresh blood to the industry can surely be overcome, if, to quote *The Times Educationl Supplement*, '........school and society march together, the one selecting and training, the other providing the opening and assistance'.

So far as we at Moulton are concerned, we should like to think that the children left our Institute, with the memory of an experience which will be of permanent benefit to them, and also with a clearer conception in their minds of the function of agriculture, not only as a business and a way of life, but as an integral factor in national and international economy.

We should like to take this opportunity to acknowledge gratefully the help given in the initial planning of the course, by Mr Annesley Voysey, who was at one time a member of the Staff of this Institute, and who in recent years has gained much valuable experience in work of this nature under the Kent Education Committee.—*The Journal of the Ministry of Agriculture*, December 1942.

PRESERVING THE GOOD EARTH

By Sir R. George Stapledon, C.B.E., F.R.S., M.A.

Director of the Grassland Improvement Station of Britain's Ministry of Agriculture

During wartime it is easy to forget dangers which, in the long-term scheme of things, are even more pressing than many of the problems now absorbing world-wide attention.

Such a menace is soil erosion, which, in cold

fact, is the master-danger that faces posterity. Since, in the last resort soil erosion, even on the grandest scale, has been wholly the fault of man, its continuation will be equally the fault of man. Man's attitude towards this problem is the supreme test of his wisdom and of his real interest in the species he represents.

Remedial measures against the results of soil erosion, where still possible, must be exceedingly slow in their operation, while preventive measures not only demand foresight, but benefits must necessarily be cumulative and spread over generations—nay, centuries.

World-wide phenomenon

Soil erosion is a world-wide phenomenon, it is not totally absent even in the temperate climate of Britain, where the conversion of forest and scrub into agricultural land has been a gradual process. In Britain, however, systems of farming are in the main adequate to take care of the precious humus which is an absolute essential to ensure a properly porous soil and to maintain an adequate plant-covering throughout the rotation.

Even so, wind erosion is not uncommon on Britain's Fenlands, and sheet erosion on steeper hill-slopes. In Britain the dangers are easy to counter, but wartime ploughing-up has served, or should have served, to warn that the land can only be mined and exploited at our peril.

It is, perhaps, ironical that the peoples of the world should have woken up to the supreme importance of nutrition, which demands an abundant supply of the right foods, only when by years of negligence vast areas of the world have been allowed to become incapable of food production as the result of sheer folly and inadvertence.

It is not too late however. Immense strides have been made in perfecting methods to counter erosion, and in practices of farming designed to produce good harvests of wanted crops of a character to obviate the starting of erosion.

The chief point to be realized is that erosion is like a snowball. From very small beginnings the most devastating results can happen in a surprisingly short time. Thus, for example, in Cyprus 'the change from fertility to aridity has been due entirely to deforestation' is pointed out in a recent book on the subject. The danger is now realized, and in the island 18 anti-erosion centres have been established.

Too much deforestation

Speaking quite generally, the beginnings of erosion in most countries have been due primarily to deforestation on too grand a scale and without any thought of establishing systems of farming and practices designed to counter erosion from the moment the plough replaces the firestick or the axe.

Little less serious has been the over-grazing of native and sparsely-covered areas of natural vegetation. The two agents that preserve the soil both from wind storms and from deluges of rain are humus and the plant-covering. The two are mutually interdependent. Apart from the adoption of sensible crop rotations and methods of cultivation—such as strip cultivation and terracing—that are best designed to counter erosion, a major problem of arid countries appears to be the necessity to conduct researches with a view to finding the best possible means of afforestation under extremely difficult conditions.

And here it must be pointed out that the essential need is plant-cover, protection and something equivalent to a forest floor and not primarily a marketable product. Another need is to introduce into the rotation an adequate period in humus-forming vegetation and in a covering that will be impervious to erosion. In short, to endeavour to establish a closely-knit ground covering vegetation of a character as similar as possible to the grass and clover ley that counts for so much in the rotation in temperate regions.

Anti-erosion measures

In most regions of the British Empire the dangers of erosion are now realized. Thus, Australia set up its Soil Conservation Board in 1941, and Kenya created a Soil Conservation Service in 1938. Anti-erosion measures are being pushed forward in West Indies, Barbados, Basutoland, Uganda and Nyasaland, to mention but a few examples.

Taking the world as whole, it is, however, to be doubted if the extreme perils of soil erosion are anywhere fully appreciated. Man is not yet trained to take more interest in and care of posterity than in his own immediate affairs and difficulties.

Soil erosion is the longest of all long-range problems; it must be expected everywhere and countered everywhere. The problem is basic, and is fundamentally one of point of view. It must be realized that soil takes thousands of

years to develop and can be squandered and lost in a decade. No system of farming should be tolerated that does not first and foremost take care of the soil. The prime need of taking care of the soil must dictate the crops that are grown and the rotation followed and all the methods of cultivation adopted—not economics.

Soil erosion is a world problem. Man must obey the demands of the soil or perish. International trade and international relationships must needs be such as to cry halt to soil erosion and not as in the past to invite it.

VEGETABLE GARDEN INSECTS

DURING the average growing season, probably not more than six to eight seriously injurious species of insects are to be found in most vegetable gardens and, though these distribute their attention over a comparatively wide range of vegetables and over a fairly lengthy period of time, the picture is really not so black as most gardeners may be inclined to paint it, says Alan G. Dustan, Division of Entomology, Dominion Department of Agriculture.

To realize that only a relatively small number of insect species will attack the crops, to know how to recognize them and understand what to do about them will assist in protecting gardens when invasion by these insects begins.

The following insects are those which in all probability, will be the only ones which will cause any material loss during the average gardening season in Eastern Canada.

Cutworms are probably the most generally destructive insects found in the vegetable garden They are of greatest concern when the plants are small. They are gray to brownish caterpillars which hide in the soil during the day and emerge at night to feed on a wide variety of plants. They usually sever the stems at the soil surface, although some species attack the leaves. Cutworms can be killed by sprinkling poisoned bran bait about the garden, in the late evening.

The *cabbage maggot* will probably be the next insect to appear. This maggot attacks the roots of such plants as cabbages, cauliflowers and radishes. It is a small, white, legless insect that makes its appearance about the middle of May. When the attack is severe, many of the plants wilt and die. Transplants and seedlings can be protected by pouring corrosive sublimate solution around the stems about the time the plum trees come into blossom.

A near relative to this insect, the *onion maggot*, is a frequent visitor to gardens where onions are grown. The onion maggot closely resembles the cabbage maggot in appearance and works in much the same way. However, it only attacks onions – feeding at the base of the stems and causing the young plants to wilt. Covering the onion seed with dry powdered calomel before planting will considerably reduce the amount of injury.

A small, yellow and black striped beetle, known as the *striped cucumber beetle*, will be an unwelcome visitor in most gardens about the time cucumber plants are getting started. It feeds on young cucumber, squash and melon plants, eating holes in the leaves. It hides in the foliage and frequently escapes detection. Infested plants should be dusted with calcium arsenate and gypsum, mixed 1 part of the poison to 19 parts of the powder.

In Eastern Canada, seedling carrots are frequently attacked by a small, whitish maggot which is the young of the *carrot rust fly*. This maggot is first noted in early June, making rusty-red tunnels in the roots. Injured seedlings wilt and die and sometimes the damage is quite severe. By delaying the planting of the carrot seed until early June, most of the carrot rust flies will have disappeared before the young seedlings come up through the soil.

By mid-June potato plants will be well above ground and the Colorado *potato beetle* will be at hand to attack the new crop. It is an annual visitor frequently to be seen on the surface of the ground even before the potatoes have broken through the soil. Spraying or dusting the vines with an arsenical, such as calcium arsenate or lead arsenate, fortunately will kill most of the beetles as well as the young grubs on the leaves.

Green worms or caterpillars will probably be noticed on cabbages, cauliflowers and allied plants during late June and early July. These are known as imported *cabbage worms*. They feed on the outer leaves at first but later bore their way into the heads. Dusting the central part of each plant, when the caterpillars first appear, with diluted arsenate of lead will give adequate protection.

Slugs though not insects, sometimes cause serious losses in gardens but usually only during periods of abnormally wet weather or

if the vegetables are growing in very damp soil. The feeding of slugs can be effectively checked by dusting the infested plants, as well as the soil beneath, with hydrated lime. This should be done in the late evening for best results.

If every vegetable grower learns to recognize these eight pests and has acquainted himself with the standard methods of control he need experience little crop loss from insect attack in the garden in the average season. The Division of Entomology, Dominion Department of Agriculture, Ottawa, will send full information regarding the control of different insect species attacking vegetables, including the above, on request.—*Department of Agriculture, Canada.*

ERADICATE ANNUAL WEEDS

EVEN when the most effective methods of eradication are employed the eradication of annual and biennial weeds is a long-time operation.

Annual and biennial weeds grow from seed and the seeds are capable of remaining alive in the soil for many years. Experiments have shown that the seeds of mustard can remain dormant in the soil for over fifty years, says George Knowles, Experimental Farm, Ottawa. There is no economical means of killing weed seeds in the soil, with the exception of soil used in green houses. The only practical way to get rid of them is to encourage them to germinate and then kill the seedlings before they mature.

All weed seeds in the soil, unlike the seeds of cultivated crops, do not germinate when the farmer prepares a good seed bed. Only those seeds which are near the surface—with the exception of wild oats and wild buck-wheat—show any inclination to take advantage of the good seed bed which has been prepared. The weed seeds which lie below this level seem to know they cannot make the grade and remain asleep (dormant) until they are brought near the surface by some form of tillage.

What hope then has the farmer of controlling annual and biennial weeds ? They can be suppressed by a good stand of a fast growing crop. The aim should be to have crops beat weeds in the race for survival. A dense, fast growing crop of grain will crowd out annual and biennial weeds to a considerable extent. Where annual and biennial weeds are a problem grain should be seeded fifty per cent heavier than the normal rate of seeding and fertilizer should be applied in the drill with the grain to promote a rapid early growth.

Another effective means of controlling annual and biennial weeds in a grain crop is to harrow the grain as soon as weed seedlings emerge. On stubble land, however, this method of control is not practical due to the collection of trash in the harrow.

Infestations of annual and biennial weeds can be reduced by judicious summer-fallowing. The aim should be to encourage the germination of as many weed seeds as possible and then to kill the seedlings by cultivation. In so far as the control of annual and biennial weeds are concerned it is a mistake to cultivate when there are no weed seedlings to kill. Too much cultivation drys out the soil and prevents germination of weed seeds.

The control of annual and biennial weeds by chemicals offers considerable promise but more information is still needed regarding herbicides.

In the sections of Canada where dew is prevalent it has been found that annual and biennial weeds can be almost completely controlled in a grain crop by dusting with calcium cyanamid. The action of this herbicide is dependent on the presence of moisture. Cyanamid alone is not an active herbicide when applied on dry foliage. However, it appears that this deficiency may be overcome by a mixture of cyanamid and calcium chloride dust.—*Department of Agriculture, Canada.*

New Books and Reviews

A PLAN OF ECONOMIC DEVELOPMENT FOR INDIA

By Purshotamdas Thakurdas, J. R. D. Tata, G. D. Birla, Ardeshir Dalal, Sri Ram, Kasturbhai Lalbhai, A. D. Shroff and John Matthai (The Commercial Printing Press, Bombay, 1944, pp. 54, Re. 1)

NATIONAL economic planning has a special appeal in this country. People think that it is necessary not so much for 'reconstruction', or what is known as 'transition from war to peace', as for national development. The plan briefly outlined in this pamphlet is significantly not a plan of post-war reconstruction, but a plan of economic development aimed at raising the notoriously low standard of life in this country to an absolutely higher level.

The main points in this Plan which have attracted widespread attention and stimulated considerable thought may be summarized as follows :

(1) India should aim at a target of three-fold increase in the national income in 15 years—an increase from Rs. 2,200 crores to Rs. 6,600 crores on the basis of prices prevailing in 1931-39. This means a doubling of the national income, when we make allowance for the increase of population at the rate of 5 millions a year. In the absence of reliable estimates of the present national income, the figures are merely illustrative.

(2) The net income from industry is to increase by 500 per cent and contribute 35 per cent to the total national income, instead of 17 per cent as at present ; the net income from agriculture is to increase by 130 per cent and contribute 40 per cent to the national income, instead of 53 per cent as at present ; the net income from services is to increase by 200 per cent and contribute 20 per cent to the national income, instead of 22 per cent as at present. The authors of the plan want to create a balanced economy by stepping up the pace of industrialization, and proceed on the assumptions that development of agriculture is essentially limited by development of industry, and that 130 per cent increase in agricultural output is the maximum that can be expected in the planning period. The bias for industry as against agriculture is resented by critics. They say that agriculture can hold its own against industry, and that the limits to its development must not be set by the tempo of industrial development. On the other hand, the supporters of the Plan argue that there is no conflict between industry and agriculture, that 130 per cent expansion is beyond the dreams of the friends of Indian agriculture, and that planning of agriculture on the basis of an insecure export market would not be sound economic policy.

(3) Since economic development has to be broadbased on the development of productive power, priority will be given to basic industries, such as power, mining, metallurgy, engineering, machine-making, chemicals, transport, etc. Consumer goods industries will also expand during the planning period, but they will expand slowly (owing to re-investment of about 16 per cent of the rising national income) ; and it is proposed that since cottage industries require a small capital base, in the interests of economy of capital such industries would be required to produce consumer goods during the period of transition. The implication that cottage industries may pass through a process of extinction after the planning period, is bound to be resented by those who believe in decentralization of industry and the employment aspect of industrial development in a country in which labour is cheap and capital dear. (4) The total capital requirements have been estimated at Rs. 10,000 crores, which is more than 14 times the total capital already sunk in our industries, barring transport, up to the beginning of the war. (6) It is assumed that the Plan will be executed by a National Federal Government which will exercise jurisdiction in economic matters over the whole of India.

The Bombay Plan has raised two far-reaching issues which may be briefly reviewed. Although the authors of the Plan plead for individual liberty, freedom of enterprise and freedom of consumers' choice, yet, as they perhaps realize fully, state planning of economic life requires an elaborate technique of controlling production, consumption, currency, trade and distribution to avoid bottlenecks and secure distributive justice. Apart from the difficulty of reconciling state control and state enterprise with economic efficiency, the time required

for training up a large technical personnel who will execute the Plan is a limiting factor. It would be interesting to see how the Bombay planners will face this issue in a subsequent report. Another fundamental issue which they have not yet squarely faced is that of a fair distribution of the burden and benefits of a planned increase of national income. If inequality in the distribution of wealth is not reduced, but is accentuated, an increase of wealth and income as the result of increased production will not raise the general standard of life to any appreciable extent. The methods of financing the Plan suggested in the book under review aroused serious misgivings. The proposal that, to the extent to which the Plan could not be financed by voluntary savings and foreign capital, it will have to be financed (to the extent of Rs. 3,400 crores) 'by created money', has startled many. The immediate reaction was that this was a scheme of inflationary finance which imposes taxation of the most regressive character upon the masses of the population. It was no good answer to say that if a war could be financed by taxation by means of inflation to a certain extent, a plan of national welfare could as well be financed with the same technique. Subsequently Mr G. D. Birla took up a sensible view by saying that if the nation is able to collect 1,000 crores in the form of sterling balances, Rs. 700 crores by way of foreign capital, and Rs. 300 crores out of hoarded wealth, the balance of Rs. 8,000 crores has got to come out of savings. Whether this sum, which amounts to 16 per cent of the estimated average national income during the planning period, can be saved (not entirely voluntarily), and, if so, what appropriate fiscal devices are needed to extract it without throwing too heavy a burden upon the masses, are technical questions which have not yet been tackled by the authors of the Plan. On the one hand, it seems that in a country with large unemployed resources it should be possible with unorthodox methods of finance to direct these resources to fuller employment based on optimum economic development. On the other hand, it has also seemed to many that in a country with such a low *per capita* income, a saving of 16 per cent of current national income will involve too much of privation and restrict effective demand so much that productive capacity will either fail to expand or face serious bottlenecks.

One or two comments on agricultural planning as envisaged in the Bombay Plan would be of interest to readers of INDIAN FARMING. The bias of the Bombay planners for industry is intelligible. But they seem to overstate the case for intensive industrialization by arguing that industrial potentialities have remained unexploited, implying thereby as if agricultural possibilities have been exploited to the optimum point. It is argued that 'it is not likely that more than 130 per cent increase will be absorbed within the country.' But what about an export market for Indian agricultural products ? Their answer is that 'India should not aspire in the initial years of planning to export to foreign markets'. But why ? Critics have retorted by saying that this is unfair to the farmer ; his purchasing power should increase through the development of export markets, and, moreover, unless India is able to sell primary products in large quantities after the war, she will find it impossible to buy capital goods in required quantities. The authors of the Plan have also failed to suggest necessary alterations in the institutional structure of Indian agricultural economy. It is abundantly clear that without radical changes in the system of land tenure and the systems of rural marketing and finance, an improvement in the facilities of irrigation and in methods of cultivation cannot go very far. Thus nationalization of land, organization of collective farming on the initiative of the State, and formation of rural cooperatives as instruments of marketing, finance and distribution are some of the economic issues which can never be shirked by a national government which truly represents the farmers of India.—B.N.G.

From All Quarters

HOW TO DO IT IN WARTIME

HERE is the sketch of a small zamindar who has shown how by adapting his crops to wartime needs he has proved useful to himself and to the country.

Shafiq's father was a middle class zamindar owning about 10 acres of irrigated land in the hill district of Kangra. The two usual crops of wheat and rice were raised by the tenants on the *batai* system, whereby half of the produce is taken by the landlord. This custom had been followed since the olden days and even the first year of war had seen no change in it.

But Shafiq was an educated young man. He had his aspirations. When war broke out and he heard about people making easy money his age asserted within himself a desire for his share of the war's spoils. He wanted to take out a military contract, but his father refused to stake his meagre resources on the wild aspirations of his inexperienced son. In the meantime the prices of foodstuffs had gone up considerably. There had also sprung up a very keen demand for vegetables and potatoes from the military training camps. This sent back his thoughts to his lands and he decided to apply his education to his crops. He wanted to grow more economic crops in place of rice and wheat. After some hesitation his father agreed to put 3 acres of his land in the charge of his son. This happened early in 1941.

Shafiq put himself whole-heartedly into the land. The fields were surrounded by hedges which had never been trimmed by the easy-going tenants. His first job was to push them back to their original position. Then he removed the unnecessary *bunds* and laid out the whole place properly making irrigation channels and drains wherever needed. In this process he reclaimed about ½ acre of useful land.

He realized immediately that rice and wheat were essential to provide the necessary grain for the workers. So he decided to retain 1 acre under rice and wheat and to put the other 2 acres under more economic crops.

Being educated Shafiq took council from the Department of Agriculture about seeds, manures, new crops, etc. For the mild seasons of the locality the agricultural expert gave him the following cropping scheme as a guide for the growing of new crops :

Summer period (1 June to 15 September)	Early winter period (1 September to 31 December)	Spring period (1 January to 31 May)
Summer Vegetables	Potato	Potato
Summer Fodder	Early Winter Vegetable	Onion
Ginger	Winter Vegetables	
	Winter Fodder	
	Teazel	

Papita to be grown in sheltered places in the hedges only.

Shafiq carried out the instructions faithfully. He first replaced the old seeds of rice and wheat with the improved seeds. For new crops he chose potato, vegetables, ginger, onion, berseem and maize.

The change in cropping did not go very smoothly in the beginning and Shafiq had to face difficulties, particularly due to the shortage of labour and manure. But he was ingenious in overcoming his difficulties. He applied all that science could give him for solving his problem.

Among labour saving devices he gradually found that the wheel type hoe and the horse hoe were useful. He also found that potatoes could both be planted and lifted much cheaper with the plough. As a further means of saving labour on frequent weedings he adopted a system of mulching his crops with the leaves of trees which he found in abundance in the nearby jungle. These mulches also saved labour employed on frequent irrigations in the dry seasons and when ultimately ploughed it became useful manure. The artificial fertilizer (sulphate of ammonia) was used with advantage on potato and cabbage. Shafiq also started the system of stall feeding his pair of bullocks. Formerly they were grazed on grazing land with the result that all the dung was wasted. Now it is pitted. The bullocks are fed on maize and berseem ; the grass in his portion of the grazing land is turned into hay and used during the winter months. As a result of this change in his policy he has found that not only his supply of manure has increased but the bullocks have greatly improved in health and working

capacity. As time passes the land is also getting richer, and so is Shafiq.

The changes made in his cropping have increased his production of foodstuffs enormously and his income has gone up several times. Formerly the annual production from these 3 acres of land was 32 mds. of rice and 17 mds. of wheat.

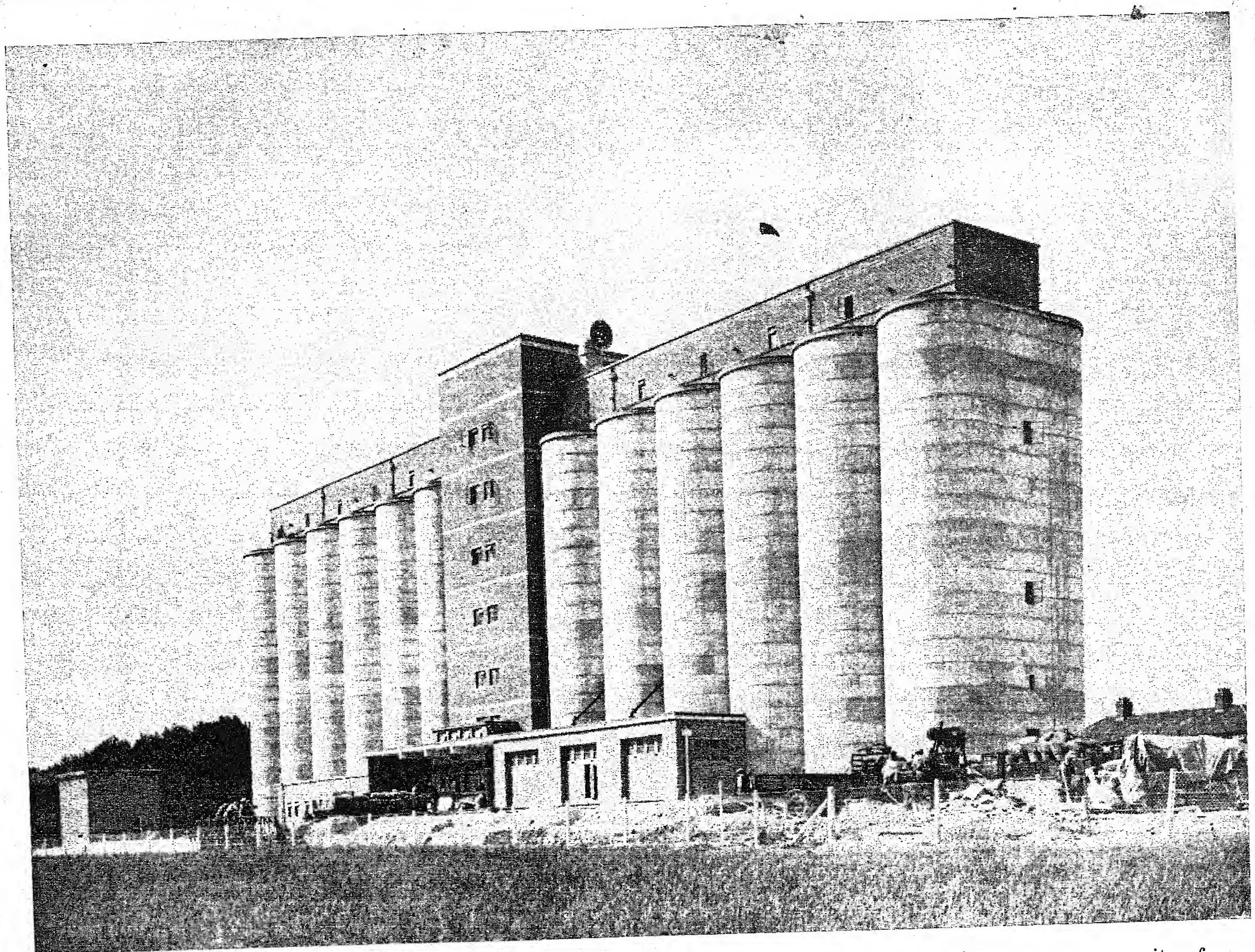
His production chart for the agricultural year 1942-43 stands as under :

Rice	1 acre	14 mds.
Wheat	1 acre	7 ,,
Summer vegetables	1 acre	68 ,,
Ginger	½ acre	85 ,,
Maize	¾ acre	Sufficient for feeding bullocks in summer. Green cobs also used as human food.
Potato (winter)	½ acre	28 mds.
Potato (Spring)	¾ acre	55 ,,
Early winter vegetables	¾ acre	92 ,,
Winter vegetables	½ acre	
Onion	½ acre	35 ,,
Papita	In hedges only	9 ,,
Vegetable seeds	(Small plots from the usual crops)	Sufficient for own use, also sold worth Rs. 36.
Berseem	½ acre.	Sufficient for providing green fodder in winter.
Teazel	¼ acre.	Sold worth Rs. 1,300
Honey	One hive	11 lb.

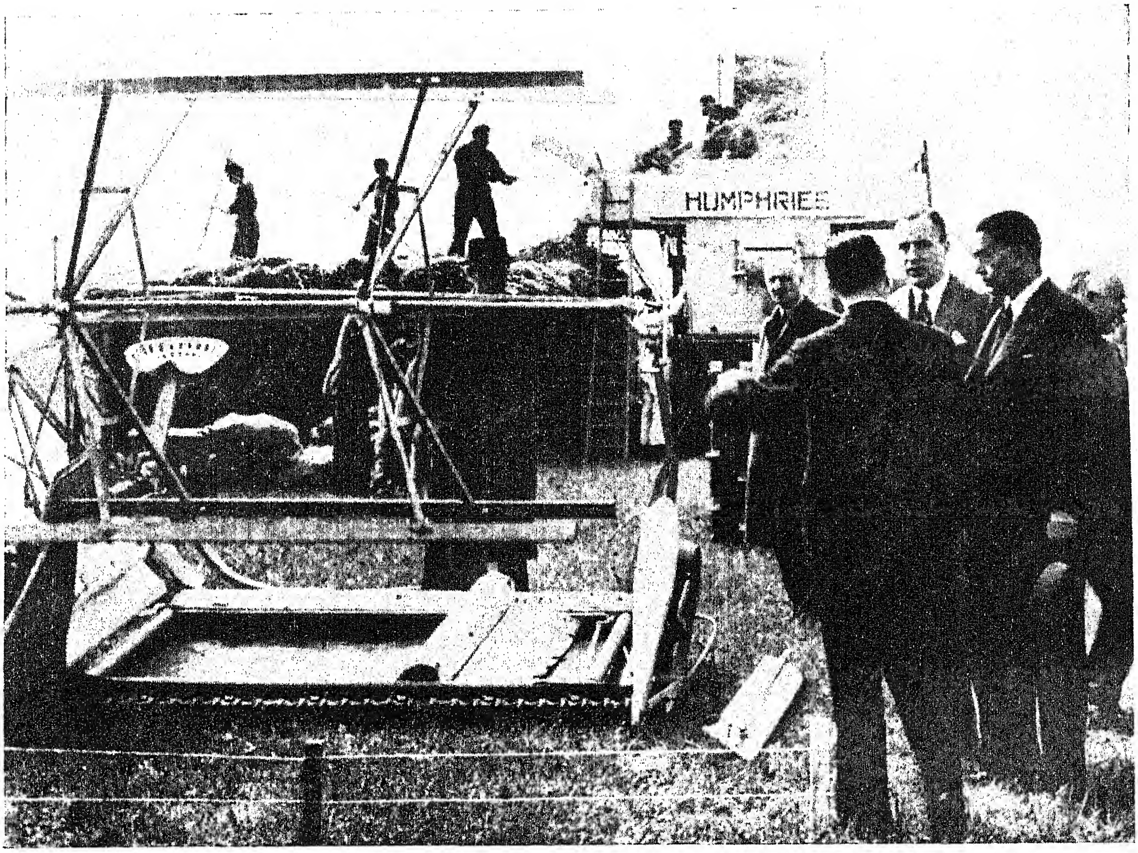
Shafiq is now raising his own vegetable seeds which were formerly imported such as knol khol, English turnip, English radish, English carrot, lettuce, English peas, etc. He has found this line more profitable and intends to put more area under these crops in future. He has also put in an improved beehive which brought him 11 lb. of honey in the first year. The crop of Teazel grown in ¼ acre only, brought in Rs. 1,300 cash, and incidently it helped in supplying this badly needed material to the woollen mills which were manufacturing blankets for the use of the Defence Forces. Far-sighted as Shafiq is, he has invested a part of his income in the planting of fruit trees in 1½ acres of his land to provide against possible post-war slump.

Shafiq is now the emblem of industry in the village. All come to him for advice. The extra income which he has made, has earned for him and his family a new respect. His father is pleased with his work and has promised to marry him to a beatiful girl as soon as War is won.

Shafiq is digging harder than ever before and now to bring that auspicious day nearer.—Malik Amanat Khan, B.Sc.(Edin.), P.A.S. Jullunder, Punjab.



A grain silo, one of the fifteen in the English countryside, built by the Ministry of Food, with a storage capacity of 5,000 tons. Each silo consists of a central brick-built working tower, containing the drying plant, with two reinforced concrete wings, each of which contains a nest of twelve storage bins—allowing intake, drying and sacking-off within a small area.



Sir Firoz Khan Noon, accompanied by members of the Hertfordshire War Agricultural Executive Committee, inspecting agricultural machinery at the Oakland Farm Institute, Hertfordshire, and discussing India's need for agricultural equipment.

PLATE 26

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V JUNE 1944 No. 6

CONCERNING MYCOLOGISTS

THE science of mycology is, to the layman, either something abstruse or comic, as his smattering of experience with the subject may dictate. The mycologist is a bit of a crank, who amuses himself collecting curious mushrooms, or a person with a myopic view of life and removed from the world by much gazing through a microscope. Only in startling, freakish spasms does the world catch a fleeting glimpse of the thrills of discovery which come to the insatiable, knowledge-seeking scientists who study fungi. We are passing through just such a moment while, for a few brief months, the world thrills to the story of the discovery of penicillin.

Long before penicillin was thought of, it was well known to the plant pathologists, who study plant diseases, that some fungi produce substances which inhibit the growth of other fungi and of bacteria. Erwin F. Smith, the great American plant bacteriologist, wrote about it in 1905. Before Fleming studied his accidentally contaminated Petri dishes, which brought this strange phenomenon before his inquisitive gaze, two other English workers, Millard and Taylor, found that the scab disease of potatoes could be reduced by adding to the soil materials which encouraged the growth of other micro-organisms able to produce substances inimical to the growth of the scab organism, *Actinomyces scabies*. American workers discovered that a fungus called *Trichoderma lignorum* produced a chemical substance which, both in pure culture and on addition to the soil, inhibited the growth of *Rhizoctonia,* a fungus causing a disease of potatoes and many other plants. They grew the fungus, isolated and concentrated the active substance, and determined its properties. Other workers went further, and concentrated on the particularly devastating disease of cereals known as 'take-all', which causes the rotting of roots and stems of wheat. Investigators in Canada, Australia and Britain pressed forward with this work, and at the present time, the Ministry of Agriculture in England is utilizing the results of the researches of scores of mycologists, who between them have discovered how to control the disease by encouraging the development of other organisms.

Mycology, and its closely related science, plant pathology, are two sciences which demand a wide outlook and a general working understanding of a number of sciences which would seem to the layman to be unrelated. Fungi are generally regarded as minute plants, threadlike in structure and devoid of chlorophyll. At the same time, in their lower orders they are closely related to the lower forms of animal life. Yet again, in their nutritional requirements, they are like neither animals nor higher plants, and there are several distinct groups which differ from one another in nutritional requirements as much as plants differ from animals. To gain any deep insight into the cultural and nutritional requirements of fungi, a working knowledge of chemistry is needed, while to deal with the more important modern fermentation processes, such as the manufacture of citric acid and penicillin, much more is needed, including some practical knowledge of physical chemistry. The manufacture of beer and wines is an art as much as a science, but nevertheless, the manufacture of alcoholic beverages in new countries of the British Empire would not have developed in the absence of pure-culture technique of a high order.

In plant pathology, the need for a knowledge of related biological sciences is very great. Ability to grow healthy plants is essential, for it is useless to attempt to find out a practical

means of controlling a plant disease if the worker does not know the best practices adopted by the cultivator. A weakened, sickly plant often behaves quite differently to fungous attack from a plant which is well supplied with the proper nutrients and given ideal conditions for healthy growth. A knowledge is required, too, of the various crop plants and of the wild plants related to them, for these often harbour the disease-causing fungi, and successful control of the diseases can only result if the behaviour of these plants is understood. The classical example of wheat rust, with its alternate host, the barberry plant, is well known, but it is not always appreciated that there are hundreds of similar cases in which the plant pathologist has to study the rôle played by the alternate or alternative host. Thus a knowledge of wild plants plays an important part in the daily work of the plant pathologist. In selecting resistant strains of plants and breeding resistant varieties, the plant pathologist requires an understanding of elementary genetics, and he needs to know what species and varieties of plants to look for as possible material for breeding purposes. He must have some knowledge of breeding technique and of crop varieties — what now-a-days is called economic botany.

However, all this supplementary knowledge forms only the background to the real job of the mycologist. That job is to know the fungi in all their incredible variety of form and size, of shape and colour, of habit and food requirements, of response to temperature, humidity, light, acidity, salt concentration, their need for special food substances, their pathogenicity, their growth as saprophytes or parasites, the innumerable characteristics of the fungi which have made them one of the most complicated of all natural studies. In all these characters, each fungus species has its own properties. There are some 37,000 known species. The layman often expresses his impatience at the time and energy spent by the mycologist in describing the characters of species of fungi in detail. He speaks, often with derision, of the waste of time in measuring to the nearest thousands of a millimeter the length of a spore, and cites the unimportance of counting the 'whiskers' of a fungus fruiting body and deciding whether a spore is egg-shaped or elliptical. The layman, however, is wrong, because most of what is worth while in the accumulated knowledge of applied mycology has depended upon the fastidiousness of the mycologist who devoted his time to this kind of work. One or two examples from Indian experience will illustrate this.

For some years, at the beginning of this century, it was believed likely that the rusts of cereal crops survived during the hot weather on the plains of India on wild grasses. A very thorough study of the rusts of these grasses indicated that each differed in one way or another from the cereal rusts, and eventually it was concluded that the means of survival of the latter must be sought elsewhere. Then the possibility of the rust surviving on the alternate host, the barberry, was investigated, and it was found that, although barberries in the Himalayas are frequently attacked with the aecidial stage of a rust, it is again a different species from any of the cereal rusts. After many years, it became evident, as a result of a most elaborate study of the rust epidemics of the plains, that the disease, at least in many cases, blew down from the hills, and that epidemics on the plains often originated in the hill crops of wheat and volunteer plants. The effect on policy was profound. Instead of working to breed rust-resistant varieties for the plains, effort was concentrated on stopping the outbreak at the source, firstly by breeding resistant varieties for the hills, and secondly by prohibiting the growing of wheat crops during certain seasons of the year in the hill areas, coupled with eradication of volunteer plants. All these stages of the campaign to control cereal rusts are traceable directly to fundamental, descriptive work and accurate measurements with the microscope.

A second example is to be found in the serious disease of wheat now known as Karnal bunt. This disease was at first thought to be very similar to the common European bunt, and it was reasonably hoped that seed treatment with copper or mercury dressings would be effective in its control. Experimental results were disappointing. In 1937, while on a visit to India, Professor A.H.R. Buller, a distinguished English mycologist who has spent most of his life in Canada, studying the different ways in which fungus spores are formed and dispersed, pointed out that the basidiospores formed by the Karnal bunt fungus were much more numerous, and behaved in a different manner after formation, from those of the European bunt, and rightly pointed out that it belonged to a different genus. It has since been discovered that the mode of infection by this fungus is entirely different from the European bunt. It is air-borne, and any attempt to control it by

seed dressings is a waste of time. Some other means of control will have to be adopted.

It might be thought that the collection and description of fungi occurring on wild plants at high altitudes, deep in the Himalayas, could be of no value to the cultivator on the plains. Yet the reverse is the case. In 1941 a mycologist collecting specimens in the mountains of Kashmir discovered a leaf-spot disease on an insignificant little weed growing on a grassy bank. The plant was recognized as a small wild form of celery, and the fungus as *Septoria Apii-graveolentis*, cause of a devastating blight of cultivated celery in America. Three years later, when plans for growing vegetable seeds in Kashmir to supply other parts of India materialized, the high probability that this disease, which is seed-borne, might be carried from the wild celery plants to the cultivated ones and thence through the seed to the plains, where it might establish itself and cause great damage, was recognized. Steps were taken at once to inspect all the crops in Kashmir, and the fungus was found to have gained a firm foothold. Control measures can still be taken, but without the discovery of this little wild plant, suffering from leaf-spot disease, along the grassy banks of a Kashmir mountain stream, the disease would have spread unhindered throughout India.

The study of nutrition of fungi for the purpose of classifying them has had a profound influence on industrial mycology. It has for many years been customary to classify yeasts and yeast-like fungi on the basis of food requirements. In doing so, a yeast-like fungus which goes by the name of *Torulopsis utilis* was found to have the curious property of being able to utilize inorganic nitrogen and build it up into proteins. This discovery is responsible for the widespread manufacture of 'food yeast', for *T. utilis* is the most efficient agent known for making easily digestible proteins, as well as the Vitamin B complex, from inorganic nitrogen plus carbohydrates.

These are only a few of the numerous examples that could be quoted, but they are sufficient to indicate the breadth of experience which is necessary before it is possible to make a useful applied mycologist. General scientific knowledge of wide scope is needed. Much of scientific agriculture and of industry depends upon detailed knowledge of the intricacies of form of 37,000 minute living organisms. India, in order to carry out post-war plans of reconstruction, whether for agricultural or industrial development, requires a greatly strengthened team of mycologists. It can find useful men only by taking those whose basic education in the sciences has been both broad and thorough, and grafting on to that foundation years of specialized study and experience. Men of such type, who will be prepared to undergo the long and patient journey to the goal of practical usefulness, must be attracted to the profession. There is a dearth of mycologists who at best will last for some years, and this will become a permanent handicap unless it is appreciated how slow and tedious is the road to success in this most intricate and exacting branch of science.

THE glory of the farmer is that in the division of labour it is his part to create.—Emerson.

Original Articles

REMEDIAL MEASURES FOR *TIRAK* IN PUNJAB-AMERICAN COTTONS

By R. H. Dastur

Plant Physiologist, Indian Central Cotton Committee, Bombay

The Punjab-American Cottons in the Punjab suffer from a physiological 'disease' popularly known as *tirak* or 'bad opening' of the bolls. The extent and intensity of the disease have been found to vary from year to year. *Tirak* in very intense form occurred in 1921, 1926 and 1928 and in less intense form in 1927, 1931, 1932 and 1939. Even in good crop years it appears on certain lands.

Symptoms

The symptoms first appear in the leaves which either turn yellow and are shed or droop before they are shed. Later, the bolls remain small and crack prematurely, i.e. before maturity. The seeds remain immature and bear very trashy lint. The lint does not fluff out as in the case of normally opened bolls. The weight of *kapas* per boll is therefore considerably lowered. Normally 400 to 500 bolls yield one seer (2 lb.) of *kapas* while any number from 700 to 2,000, depending on the intensity of *tirak* is required to yield the same quantity when the disease occurs. The general level of the yield is thus greatly lowered. In *tirak* years the yields of seed cotton per acre in the Punjab have been found to be reduced by 20 to 50 per cent of the normal. The enormous extent of the loss from this disease may be gauged from the total annual acreage of 1½ million acres under American cottons in the Punjab. The Punjab Government, therefore, with the financial assistance of the Indian Central Cotton Committee, undertook intensive research on this very important problem with a view to determine the causes of *tirak* and its remedies. These investigations began in 1935 and within a period of eight years the causes of this trouble have been determined and a simple and practical measure to minimize the damage caused has been evolved. A memoir dealing with the scientific and practical aspects of the whole investigation is being published by the Indian Central Cotton Committee, Bombay.

Causes of tirak

Tirak conditions develop in Punjab-American Cottons when the crop begins either to suffer from a deficiency of nutrients, especially nitrogen, or from a deficiency of water. These deficiencies appear when the crop enters the fruiting phase. The demand for nitrogen and water is greatest when the bolls begin to set in September. The leaves are the first to show signs of the disease. When *tirak* is due to a deficiency of nitrogen the leaves turn pale and yellow and are prematurely shed. When the crop suffers from a water deficit the leaves do not turn yellow but droop, hang downwards and are finally shed.

Nitrogen deficiency: The same develops on light sandy soils. Nitrogen in the soil is adequate for the vegetative growth of the plants, and the crop, therefore, shows no symptoms of *tirak* till the regular flowering season sets in at the end of August. At this stage the demand for nitrogen becomes high as it is needed for the production of flowers and fruits and cannot be met from the light soil. Nitrogen present in the leaves travels towards the fruiting parts and they, therefore, get depleted of nitrogen as it is not replenished by absorption from the soil. The loss of nitrogen causes premature senescence of the leaves which turn yellow and are shed. The deficiency of nitrogen later interferes with the normal development of bolls and indirectly produces immaturity of seeds with poor quality lint. The final result is *tirak* or 'bad opening' with low yields of seed cotton per acre.

Water starvation: The cotton crop suffers from a deficiency of water on soils which contain abnormal amounts of harmful salts in the sub-soil. The first two or three feet of the soil are relatively free from salinity, while the lower layers contain these salts in large amounts.

On soil of this type the cotton crop makes normal growth up to September but later it begins to show symptoms of water starvation. The water requirement of the crop is maximum at this stage since the plant is bearing the maximum number of leaves. The moisture from the upper non-saline layers of the soil generally dries up in about 10 days after the usual irrigation, while the presence of salinity in the sub-soil interferes with the normal absorption of water from the deeper layers. Consequently, a condition of physiological drought sets in and the leaves begin to droop. They remain in that position at all hours of the day and night. This does not happen on normal non-saline lands. Finally the drooping leaves are gradually shed.

Once the balance between the demand and supply of water gets upset, other functional activities of the leaves are also adversely affected. The food manufacturing processes of the leaves receive a setback which in turn affects the growth of the plant, especially of the bolls, which remain small, crack prematurely and contain immature seeds.

Intensity and spread of tirak

If the weather conditions during the fruiting months, i.e. September and October, are unusually dry and warm continuously for a number of days, greater loss of water from the crop results than is usually the case. Thus water starvation increases and, consequently, the intensity of *tirak* also increases. Such unfavourable weather conditions also cause *tirak* to spread to soils with low or medium salinity. Thus larger areas may become *tirak*-affected in years of unfavourable weather conditions.

The task of determining the causes of *tirak* was rendered difficult on account of three reasons :

1. The cotton soils with saline sub-soils and soils deficient in nitrogen are found intermingled even in small areas of only an acre or two. The degree of sub-soil salinity or of nitrogen deficiency was found to vary from spot to spot within a small area. The soil heterogeneity thus rendered both observation and experiment difficult.

2. Weather conditions interacted with soil conditions in causing intensification and spread of *tirak*, so much so that it appeared on a given piece of land in one year and was absent in another. This interaction obscured the role played by soil factors in causing this disease.

3. Two different physiological factors, i.e. nitrogen and water supply produced simliar symptoms, viz. premature defoliation of leaves and immaturity of seeds. The problem to determine the causes of *tirak* thus became complicated.

Remedial measures

The application of nitrogen in the form of sulphate of ammonia to nitrogen-deficient light sandy soils and the application of extra irrigations, either in the form of heavier doses or at shorter intervals than normal during the fruiting period were found to be the best remedies for *tirak*. But the chequered nature of the cotton soils did not make possible their use on a practical scale. These remedies are specific and must be applied at the right places. Application of nitrogen in the form of sulphate of ammonia to soils with sub-soil salinity would not prove a remedy. Similarly, the application of extra water to nitrogen-deficient soils would have no effect. The soil heterogeneity and the two different physiological factors associated with *tirak*, involving application of two different remedial measures, stood in the way of remedying it on a practical scale.

It was, therefore, necessary that the remedial measures should be such that they would ameliorate *tirak* occurring on account of nitrogen starvation and of water starvation. The measures should also be such that they would not adversely affect the growth of the crop on normal lands.

The damage caused by *tirak* can be reduced by ensuring that the crop does not suffer from a deficiency of either nitrogen or water or both at the time of fruiting. A reduction in plant size was, therefore, conceived to be the most practical way to attain that end. The most natural way to reduce plant size seemed to lie in shortening the vegetative growth period by delaying the sowing of the plant for a period to be determined experimentally.

Cotton sowings in the Punjab generally begin in the first week of May. The effect of June sowing on plant size and consequently on *tirak* on both soil types was, therefore, studied experimentally. This measure proved extremely successful in the first year of its trial. A field having saline sub-soil was divided into 48 equal plots of which half were sown at random in May and half in June. *Tirak* appeared in the May-sown plots while the plots sown in June were found to be almost free.

The measure of late sowing was, therefore, tried out in succeeding years on soils where nitrogen deficiency caused *tirak* and also where both *tirak*-promoting conditions were found to be present together, i.e. on light sandy soils with saline sub-soils. The measure was also tested in the various cotton growing districts of the Punjab using the commonly cultivated American varieties. The net result of these trials was that the crop sown in June suffered much less than the crops sown in May. Late sowing was found to be a common measure suitable for all soil types. The practical difficulties arising out of soil heterogeneity were thus surmounted.

Close spacing for June-sowings

The June-sown crop, however, suffered from one serious disadvantage as compared with the May-sown. As the vegetative growth was shortened by delay in sowing, it produced a smaller number of bolls per plant. Thus *tirak* could be ameliorated but the advantage gained by better opening was lost by a decrease in bearing. This disadvantage was counteracted by closer spacing of plants, i.e. by increasing the number of plants per acre. Cotton plants in the Punjab are generally sown in rows 3 ft. apart. The plant to plant distance is generally $1\frac{1}{2}$ ft. The reduction in boll number per plant caused by June-sowing was avoided by spacing the rows at $2\frac{1}{2}$ ft., 2 ft. and at $1\frac{1}{2}$ ft. successively as the sowing date advanced. Similarly, the plant to plant distance was decreased from $1\frac{1}{2}$ ft. to $1\frac{1}{4}$ ft., 1 foot and to 9 in. as the sowing date advanced in the month of June. The importance of steadily increased closer spacing of plants with the advancing sowing date was demonstrated by a number of experiments. It was found that great increases in the yields were obtained by adopting June-sowings with close spacing.

It was found that the application of late sowing as a general measure for all cotton sowings in the Punjab might cause certain practical difficulties: (1) If the cotton sowings were deferred from May to June, the date of final irrigation might also have to be postponed by a month and such a practice would therefore interfere with wheat sowings. (2) A late sown crop might mature late and thus be exposed to damage from early frosts. (3) As the June-sown crop was more tender and succulent than the May-sown crop by the time Jassids generally appeared it might fall an easy prey to this pest in a year of heavy Jassid infestation.

Extensive experiments laid out at different places in the Punjab dispelled these fears. They showed that the late-sown crop did not require a late irrigation. The last date of irrigation for the crop, whether sown early or late, appeared to be in the middle of October. Irrigation later than 15 October did not give any increase in yield whatever the date of sowing. It was also found that the final picking of the crop was completed almost at the same time whether it was sown in May or in June. Damage from frost could only be suffered by the June-sown crops, when a very early frost occurred under Punjab conditions and this was seldom.

It has been demonstrated by experiments that a June-sown crop, when spaced closer, suffered less damage from Jassids than a crop sown wide on the same date. It was found that Jassid attack was more virulent where-ever the crop had not covered the soil either on account of wide spacing, or of salinity on the surface or of a very sandy soil surface. It is, therefore, essential that the June-sown crop should cover the ground before the insect appears, i.e. before the end of August, in order to escape danger from its attack.

Practical recommendations

The importance of close spacing for the June-sown crop must be emphasised. The adoption of June-sowing without close spacing will bring little benefit to the cultivators. Spacing must be regulated according to the date of sowing. To this end a schedule of sowing dates has been worked out from experiments. As the crop becomes sown closer and closer with the advancing date, it is necessary that the seed rate should also be increased progressively.

SCHEDULE A

Date of sowing	Seed rate per acre	Distance between rows	Distance between plants
25 to 31 May	7—9 Seers	$2\frac{1}{2}$—3 ft.	$1\frac{1}{2}$ ft.
1 to 7 June	8—10 „	$2\frac{1}{2}$—3 „	$1\frac{1}{2}$ „
8 to 15 June	10—12 „	2 —3 „	$1\frac{1}{4}$ „
16 to 23 June	12—14 „	2 —3 „	1 „
24 to 30 June	14—16 „	$1\frac{1}{2}$—3 „	9 in.

The Schedule A has been prepared for the guidance of cotton growers. It shows the changing seed rates and spacings with advancing sowing dates in June and has been specially prepared to suit the Punjab conditions. It must be borne in mind that the spacing recommended for each week in the schedule is an approximation and it may be found too close on rich soils or too wide on poor soils.

A cultivator is unable to sow his cotton in a single day. Sowings have to be distributed over two, three or even four weeks depending upon availability of water, sowing facilities and methods of sowing. The optimum sowing period had, therefore, to be ascertained. It was also necessary to determine by a large number of experiments, the optimum sowing period for each tract and for each commonly cultivated variety of cotton, as climatic conditions and the suitability of each variety for late sowing were expected to differ from tract to tract.

The range of sowing dates for the various localities was found to differ even if the right variety was used in the right place. In the drier parts of the province such as Multan and parts of Montgomery district, June proved to be the optimum sowing period. In these parts sowings can continue even up to the beginning of July. In localities where comparatively wet summers are more frequent, e.g. in Sargodha and Sheikhupura, delayed sowing beyond the middle of June would expose the crop to the danger of Jassids. At the same time early sowing would expose it to the danger of *tirak* in dry years. Sowings should, therefore, start by 25 May and be completed before 15 June. At such places the rule should be to start sowing late, to sow quickly and to plant thickly. For localities like Lyallpur, Jhang and that part of Montgomery which occupies an intermediary position as regards the distribution of rainfall, the sowing period lies between 25 May to 20 June.

The differential behaviour of a variety according to the sowing date was another important feature of this investigation. It was found that 289F/43 variety in the central tracts (Lyallpur and Sargodha districts) and 289F/K25 in the Montgomery district did not do well when sown after 15 June on account of a marked decrease in their boll number. 289F/K25 and 289F/124 behaved still worse under June sowings at Lyallpur. On the other hand, L.S.S. in Lyallpur and Sargodha districts, 289F/43 in Montgomery and Multan districts and 289F/K25 and 289F/124 in Multan district responded favourably to delayed sowing. These varieties are popular with the cotton growers in their respective localities and this renders the adoption of late sowing as a general practice quite easy.

The following Schedule B gives in a concise form an idea of the optimum sowing periods for the several varieties in different districts. It is based on the results of experiments.

SCHEDULE B

District	Best sowing period	Variety
Sargodha, and Sheikhupura	25 May to 15 June	L.S.S.
Lyallpur, Jhang and wet parts of Montgomery	25 May to 20 June	L S.S. and 4F. 289F/43 if sown should be completed before 15 June.
Montgomery	25 May to 25 June	289F/K25 and 289F/43. K25 should not be sown after 15 June.
Multan	1 June to 5 July	289F/K25 and 289F/124

As a general practice, it is advisable to concentrate sowings in the first fortnight of the sowing period indicated in Schedule B on light sandy soils or on soils of low fertility, where growth is expected to be unduly depressed if sown very late. The remainder of the sowing period can best be utilized for sowings on sandy loam where the growth of very late sown crops is sufficiently rapid to cover the soil.

Practical application of late sowing

To set up late sowing on a practical basis and to get an idea of the actual benefit derived from the adoption of this measure, it was necessary to test late sowing on a large scale. The British Cotton Growing Association Farm, Khanewal, was the first big commercial farm to take the lead in this direction and offer cooperation to test this measure extensively. A replicated sowing-date experiment with 289F/K25 variety was arranged in different villages on the Estate in 1940 and was repeated in the two succeeding seasons. The experiment was so arranged that it covered all types of land.

Each year, 12 strips of land, 2 acres each, were selected. The 12 strips were distributed over 10 to 12 different rectangles (1 rectangle = 25 acres) of a *chak*. Each two-acre strip was sub-divided into four $\frac{1}{2}$ acre plots which were sown on four different dates. Thus there were 12 replications of four sowing dates. Six acres of crop came under each sowing date. The seed rates and spacings were according to Schedule A. The yields obtained in each year are given below :

CHAK NO. 75 (1940–41)

Sowing date	19 May	4 June	19 June	5 July
Yield in mds. per acre	12·62	14·48	16·10	14·62

CHAK NO. 83 (1941-42)

Sowing date	20 May	5 June	20 June	5 July
Yield in mds. per acre	5·38	6·47	7·06	5·77

CHAK NO. 81–82 (1942–43)

Sowing date	22 May	7 June	21 June	15 July
Yield in mds. per acre	9·49	14·87	15·48	8·57

June-sowings were consistently better than either May or July sowings and the highest yields were obtained from the crops sown about 20 June. This simple measure of deferring sowing by about three to four weeks from the first to the last week of May has now been adopted with great benefit by many big zemindars in the Punjab. At the B.C.G.A. Farm, Khanewal, May-sowings have been abandoned in favour of June-sowings since 1940. Sowing is also now done according to the two schedules on other big estates such as the Military Farm, Okara; Iqbal Estate, Iqbal Nagar; S. B. Ujjal Singh Farm, Mianchannun.

An approximate estimate of the benefits derived by the adoption of June-sowing with close spacing can be derived by studying the average yields per acre at the B.C.G.A. Farm, Khanewal, for the four years (1936-1939) when sowings were done in May and for the succeeding four years (1940-1943) when in conjunction with close spacings, they were done in June as recommended. The total area under cotton on this farm was about 1,600 acres annually.

MAY-SOWN CROP

Year	1936	1937	1938	1939	Mean
Yield per acre in mds.	12·76	7·77	7·42	3·65	**7·90**

JUNE-SOWN CROP

Year	1940	1941	1942	1943	Mean
Yield per acre in mds.	14·56	9·75	16·50	9·05	**12·45**

Thus the average yield per acre increased by more than 50 per cent in the last four years over that of the previous four years. The general mean yield of the farm for the last 15 years (1921-1935) is about 9 mds. per acre, and thus there is a definite indication of an upward trend in yields from 1940. It may be of interest to note that 1939 and 1941 were *tirak* years. The June-sown crops in 1941 evidently suffered much less from *tirak* than the May-sown crop in 1939, as can be seen from the differences in the yields in the two years.

HEN THAT LAYS IS HEN THAT PAYS

SYSTEMATIC culling and marketing of non-laying hens is profitable. It is one of the quickest and easiest ways of reducing costs. Not only does the systematic removal of drones and poor layers save costs but it brings better returns on the average, because the bad effect that poor producers have on the efficiency of the flock has to be considered and better prices may be obtained by marketing culls week by week than are likely than when all the culls are kept to be sold at one time later on.

During the early part of the year, some difficulty may be experienced in deciding which hens are the least productive because practically all hens lay eggs in the spring. In the early summer is the time of the year in which non-layers may be best identified. The busy hen is the laying hen. Laying hens are the first out in the morning and the last in at night. In this respect, it is an accepted practice that no serious mistake can be made in culling the last hen off the roost in the morning or the first to go to roost at night.—*Department of Agriculture, Canada.*

PRAWN CURING IN MADRAS

By P. I. Chacko
Assistant Director of Fisheries, Inland Development, Madras

THERE is an extensive prawn fishery in the Madras province. In the fish markets of Madras city, prawns top the list of fishes both in quantity and value. In the fishing industry along the Malabar and South Kanara coasts, prawns fluctuate between the first and fifth places in quantity and value. The season for the prawn fishery is from January to April, but in the shallower regions of the Arabian Sea and in the Collair Lake, the fishing is practised from May to December. Prawns are captured with the help of basket traps, cast nets, stake nets and shore seine nets.

Nutritive value of prawns

Prawns have a high nutritive food value as they have the property of storing great quantities of animal starch (glycogen). They also contain a high percentage of calcium, phosphorus, iron and iodine (altogether about 20 per cent) and about 30 I.U. of Vitamin B. Sometimes the quantity in excess of what is locally consumed in the fresh condition is cured in the following four ways in the province :

(1) *Sun-drying :* The prawns are spread on the ground or on bamboo mats and dried in the sun and are occasionally turned over for uniform drying.

(2) *Salting and dring :* This method is practised in the Government Fish Curing Yards of the West Coast and it consists of drying the prawns in the sun after 24 hours of salting. The shells are removed by beating with clubs. The product so prepared is better than the sun-dried prawns.

(3) *Boiling and drying :* This method is carried out as a cottage industry in Malabar, where prawns are cultured in the low-lying paddy fields. In the months of October and November, large numbers of young prawns which enter the fields with the high tides are impounded by fitting bamboo sluice-gates to the openings in the *bunds* of the fields, and are allowed to grow. After three or four months they are fished and boiled for about 15 minutes in large copper vessels in weak brine till they turn red and float. The boiled prawns are dried in the sun and are then put in gunny bags and beaten hard on the ground or with a club to loosen and remove the shells. The shelled prawns are dried again before packing and export. The shells contain a high percentage of lime and a fair quantity of nitrogen and phosphate and constitute a valuable manure for acid soils.

(4) *Smoking :* This method is largely practised in the Collair Lake area. Fresh prawns are spread on bamboo lattice work trays placed on a *tatty* scaffold over a smoky fire which burns in a trench on the ground. After four hours of smoking, during which the prawns are turned over once or twice by means of wooden ladles, the shells are removed by trampling upon the smoked prawns.

Improved methods of curing

An improved method of curing prawns was devised at the Fisheries Experimental Station, Tanur, and the product has been marketed for years as 'semi-dried prawns'. This method consists of boiling fresh prawns in 6 per cent brine for 2 minutes. Immediately they begin to float, the prawns are removed, shelled and placed in vats containing saturated salt solution, for 15 to 30 minutes. After brining the prawns are gently squeezed and spread on trays and either dried in the sun or in an artificial drier during inclement weather. The resulting product is hygienic, delicious and keeps good for days and is easily sent to distant markets packed in butter paper and small bamboo baskets. The semi-dried prawns are freshened by soaking them in warm water for a few minutes. This method of curing is therefore acceptable to all classes of fish-eating people, and is greatly appreciated in markets in the interior and in Ceylon. Semi-dried prawns have been advantageously used in the former Government fisheries cannery at Chaliyam, when fresh prawns were scarce. Experiments in storing semi-dried prawns for several months in sealed tins containing carbon dioxide gas were also successfully carried out at Tanur.

Another process which was developed at the Tanur station was that of pickling prawns. This process consists of boiling fresh prawns in 5 per cent brine, shelling them, washing the

meat in 10 per cent brine and packing in 5 per cent brine in airtight glass jars. Pickling of boiled prawns in vinegar or weak toddy with condiments and spices is carried on in Malabar as a cottage industry.

Experimental canning of prawns and prawn pastes was started by the Fisheries Department at Calicut in 1912 and later at Chaliyam. The product was popular with the public. But the effects of the slump resulting from the last Great War compelled the closure of the cannery in 1926.

A country-wide problem

The present problem is one of proper preservation, distribution and utilization of the food fish that abound in the sea, estuaries, backwaters and rivers of our country. Sun-drying which is the commonest method in practice, is very wasteful resulting in an unwholesome product. Better methods of curing have to be popularized. The manufacture of semi-dried prawns as demonstrated at Tanur, large-scale canning of prawns and prawn paste as demonstrated at Chaliyam and the installation of artificial driers to prevent the heavy wastage during the rainy season, should be commercialized by proper propaganda. A scheme for the exploitation and semi-drying of the great prawn fisheries of the Collair and Pulicat Lakes is under consideration of the Government of Madras and the Imperial Council of Agricultural Research. This move to augment the present limited food supply is a step in the right direction. The sooner the scheme is put into operation the better.

HOW TO CONSTRUCT MILK-COOLING TANK

SPOILAGE of milk is almost invariably the result of bacterial action. While the number of bacteria in freshly-drawn milk depends chiefly upon the care taken in cleaning and sterilizing the utensils and equipment with which milk comes in contact, the length of time milk will remain usable is also dependent upon the temperature at which it is held. Hence the importance of prompt and thorough cooling of milk on the farm.

Various methods of cooling milk have been advocated, but for the fluid milk trade it is generally accepted that best results are obtained by placing the cans in a well-insulated tank filled with ice water, and circulating the water to speed up the cooling process. While the ice may be placed in the tank in blocks, the greater convenience of mechanical refrigeration units is leading to their widespread use. Whichever form of refrigeration is used, it is important that a well-insulated tank be provided, otherwise heat will leak into the tank so rapidly as to decrease its efficiency and increase the cost of operation.

In co-operation with the Division of Bacteriology and Dairy Research, Science Service, the architect at the Central Experimental Farm, Ottawa, has prepared detailed plans for the construction of an insulated milk cooling tank which may be used either with natural ice or with mechanical refrigeration. Copies of these plans may be obtained free of charge by writing to either the architect or the Division of Bacteriology and Dairy Research, Central Experimental Farm, Ottawa.—*Department of Agriculture, Canada.*

DEVELOPMENT OF AGRICULTURE UNDER PERENNIAL IRRIGATION IN SIND

By M. V. Vachhani

Agricultural Research Station, Dokri

'Sind indeed is a gift of the Indus river. This age-old stream is the very life of the land. It is like an enormous oasis in the desert region'.—M. B. Pithawala.

Sind formed a part of the Bombay province till the year 1936, when it became an independent province under the new reforms. Because of its peculiar geographical position, it forms a unit itself. It is about 360 miles long from north to south and nearly 275 miles in its extreme breadth, and covers nearly 52,994 sq. miles, which is about $\frac{1}{33}$rd the area of India. Its population is about 4·5 millions. It is bounded on the west by the Khirthar range and on the east by the Rajputana desert. The Arabian sea forms its southern boundary, while to the north it extends up to the foot of the Suleman Range. Thus, it is bounded on both sides by unproductive areas, i.e. a mountainous region on the west and a sandy desert on the east.

Map of Sind showing the river Indus with its net work of canals and the area commanded by the perennial and the inundation canals.

A desert province

The rainfall is only about 5·5 in. per annum and even this small total is usually concentrated in a few heavy downpours at long and irregular intervals. Thus rainfall, as a means of cultivation in Sind, is practically negligible.

Its prevalent aridity and the absence of the monsoon make the climate of Sind one of the hottest and most variable in India. The thermometer frequently records in summer 117°F, and, occasionally, 126°F also, while in winter the temperature falls a few degrees below the freezing point. Hot scorching winds prevail in the hot weather months. The worst time for such winds is the *chaliho* or the forty dog days, commencing about the end of April.

Because of its geographical situation and the low rainfall and extreme temperatures, the province is called the 'Desert Province'.

River Indus

The Indus river is the very life-spring of the people of Sind and is of vital importance to the prosperity of this province. It enters the northern boundary after having flowed about 1,300 miles from the Himalayas, through Kashmir and the Punjab, and runs for about 400 miles right through the length of Sind, until it reaches the Arabian Sea.

The river usually rises in May and the peak is reached in August. After that it begins to fall until by mid-September it reaches its

minimum; for the remaining months of the year it is at such a low level that it is almost useless for irrigation purposes. From early days the inhabitants of Sind have utilized the water of the Indus by cutting canals wherever possible and recently by the construction of the great Lloyd Barrage which, with its net work of canals, brings an additional area of 2·5 million acres under cultivation. Two proposed projects, viz., Upper Sind Barrage and Lower Sind Barrage when constructed will irrigate 1·6 million acres and 2 million acres respectively.

Agriculture in pre-Barrage conditions

The soils of Sind, which are both made and maintained by the Indus are mostly alluvial and are fertile. They are deep, mostly loamy, with a low water-holding capacity and are slightly alkaline in reaction. A striking characteristic of these soils is their lack of uniformity over any distance, the surface soils varying considerably from spot to spot justifying a local saying that the soils of Sind vary at each step of a dove. In pre-Barrage conditions the large volume of flood water during May to September was utilized for agricultural purposes—being conveyed to the low-lying lands by means of canals. This was known as *abkalani* or the inundation season. These inundation canals flowed only during the short period when the level of the river remained high. Any fall in the level of the river during the cropping season, which is not unusual, would, consequently, result in the failure of the crops. Due to these vagaries of the river and the fact that the duration and the height of the floods could not be foretold or regulated, agriculture was precarious in Sind and the general standard of cultivation low. The cultivators' position was always one of uncertainty and they left much to *kismet* or fate. Lt. J. G. Fife has very aptly described cultivation conditions of Sind in 1855 by saying: 'With the cultivator exposed to so many risks arising from the capricious nature of the water supply, it cannot be a matter of wonder that the people should look upon cultivation as a species of lottery. They are successful one season, bankrupt the next; no one who sows can tell what he will reap. Too little or too much water, the supply coming too soon or too late and the blight arising from sowing at the wrong time combine to render speculation on the result of the cultivation a riddle which none can solve'. About three and a half million acres were under cultivation, the major portion of which was put during the inundation season under the short-season *kharif* crops like *jowar* (*Andropogon sorghum*) and *bajra* (*Pennisetum typhoideum*). A very small area, about 7 per cent was put under *rabi* crops, which were grown as *bosi*—unirrigated crops grown on the moisture conserved during the inundation season.

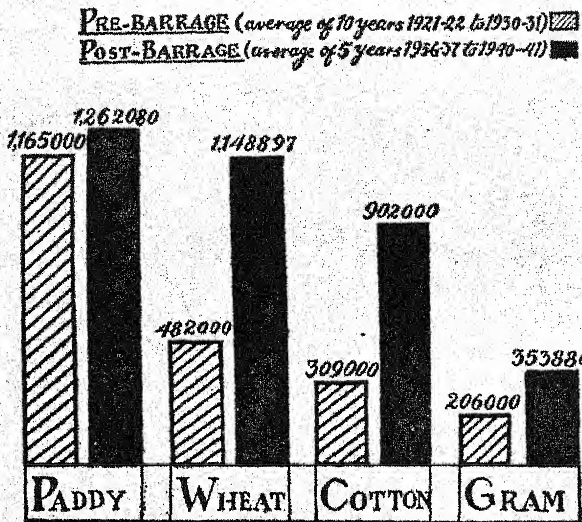


Chart comparing the area under principal crops under pre- and post-Barrage conditions.

Lloyd Barrage

With the opening of the Lloyd Barrage canals, popularly known as Sukkur Barrage canals, in 1932, a large volume of perennial and assured supply of irrigation has been made available for the cultivation of vast areas of fertile land. The keystone of the whole project is the huge dam, nearly a mile in length, pierced with 66 openings with huge gates for controlling the flow of the water of the Indus and diverting it to the high level side canals. Immediately above the dam, the seven great canals take off on both the banks of the river and distribute the water over vast areas of land. The total length of the canals with their distributaries, minors, etc. is about 6,816 miles. The cost of this huge scheme was Rs. 223 million which is the liability of the new province of Sind.

Agriculture in post-Barrage conditions

The Barrage canals started functioning in 1932 and the agricultural development during

the last decade has exceeded the expectations of even the most optimistic. The object of the scheme was to convert the large areas of inundation cultivation existing before the scheme into a perennially irrigated area and to extend perennial irrigation to the large uncultivated tracts of land. The total area commanded by the scheme is about 8 million acres. Before the advent of the Barrage, Sind was mainly a *kharif* tract, having $\frac{4}{5}$th of the area under *kharif* and $\frac{1}{5}$th under *rabi* cultivation. But according to the Barrage project the *duty* on water is 370 acres of which the permissible cultivation is 300 acres. From this 100 acres are to be cultivated during the *kharif* season and 200 acres during the *rabi* season. This means that one *cusec* of water can successfully mature 100 acres of *kharif* crops and 200 acres of *rabi* crops.

The following figures compare the post-Barrage position with that of the pre-Barrage:

Season	Percentage area under cultivation	
	Pre-Barrage	Post-Barrage
Kharif	31	27
Rabi	7	54
Total *kharif* and *rabi*	38	81
Fallow	62	19

The above table shows that under pre-Barrage conditions about 62 per cent of the culturable land was lying fallow while under the Barrage conditions it will be reduced to the bare minimum of 19 per cent. Thus intensity of cultivation was expected to be more than doubled and a large area was to be brought under *rabi* crops. These expectations have been amply fulfilled as is apparent from the chart. The total area under cultivation during the year 1940-41 was about 5·4 million acres as compared to 3·5 million acres under pre-Barrage conditions.

It is evident from the chart that the areas under wheat and cotton have nearly trebled and, what is more important, while formerly the cotton grown was all short staple, now much of it is medium staple cotton of good quality. Not only the barren land has been brought under cultivation but the increase in acreage has been accompanied by an increase in average yields of crops. In the case of cotton it has increased from 120 lb. to 162 lb. lint per acre and in the case of wheat from 520 lb. to about 700 lb. of grain per acre.

The ultimate area is planned to be 2·5 million acres under wheat which is expected to be achieved three decades after the opening of the canals, i.e. by the year 1962. The extension of wheat cultivation presents more difficulties, partly technical and partly economic.

Scientific agriculture

With the availability of the perennial and assured means of irrigation, large areas of barren land are, one after the other, coming under cultivation. In the pioneering stage, there is a rough and ready exploitation of new fertile lands, which apparently ungrudgingly, bear copious harvests but soon begin to show signs of deterioration in due proportion to the loss of soil fertility and crop diseases, etc. A desirable change in the farming system, or the changed conditions themselves, at once, therefore, make demands on the agricultural research worker for new crops, more suitable varieties, better methods of cultivation and proper methods of maintaining soil fertility, etc. Moreover, farming under irrigated conditions involves other risks as indiscriminate irrigation may result in water logging, development of *kalar* and spoiling of the texture of the soil. The Government realizing all this started, in 1926, an Agricultural Research Station at Sakrand which is situated in the centre of the Barrage zone. Another research station has since been established at Dokri to study the agricultural and irrigation problems pertaining to the right bank areas, with special reference to rice growing tracts. Besides, an Agricultural College named after His late Majesty King George V was started at Sakrand in 1940 which provides facilities for the training of sons of zemindars, in practical agriculture, estate management and also teaches them up to the B.Sc. degree of the Bombay University.

To effect improvements in a system of land husbandry requires an organized effort by a group of scientific workers, each studying the problem from his own special point of view. Special attention has been paid to the following important problems connected with the crops and soils.

Evolution of new varieties

The plant-breeding sections have been dealing with the improvement of crops and the work has been carried on along the traditional lines of selection, introduction or acclimatization and

hybridization. The success obtained during the last decade as a result of this work, has been marvellous and it can be safely said that no other single branch of agricultural science has directly benefited the cultivator of Sind to this extent. Many new strains of the various crops have been evolved which are superior in yield and quality and are better suited to the varied requirements of agriculture and commerce and the cultivation of which has brought a better financial return to the cultivators. To mention a few, *Sind Sudhar*, *M4* and *Sind N. R.* Cottons, *C.P.H. 47*, *A.T. 38* and *Punjab 8A* wheats, *Kangni 27*, *Silver Jubilee* and *Jajai 77* Paddies, *Soaro Kartuho jowar*, *torio Kazi Ahmed*, *rapeseed Ghotki*, *Jambho Jhatpat* and *til Jamesabad* are some of the most promising varieties of crops that are increasing in popularity with the cultivators as is shown in the following table :

AREA IN ACRES UNDER NEW AND IMPROVED VARIETIES OF CROPS IN SIND, DURING THE FIVE YEARS ENDING 1938-39.

Year	Rice	Cotton	Wheat	Other crops
1934-35	29,617	2,26,257	73,951	12,784
1935-36	56,765	6,03,559	88,576	1,92,236
1936-37	3,42,355	4,96,437	3,01,664	1,47,169
1937-38	3,28,068	7,84,472	3,84,851	1,73,490
1938-39	5,40,876	5,21,629	7,81,396	1,75,789
	(12,56,000)	(8,56,000)	(11,78,000)	(23,39,000)

NOTE: Figures in parentheses indicate the total area under respective crops during the year 1938-39.

Soil problems

The soil work includes studies of *kalar* or saline soils, maintenance of soil fertility by systematic rotations and application of organic and inorganic manures. The soil problems are much more difficult under irrigated conditions.

Reclamation of kalar or saline soils : lands more or less impregnated with salts locally called *kalar* are very common in Sind and consist of varying quantities of sodium chloride (common salt) and sodium sulphate (Glaubers salt). It is the degree of concentration of these on the surface which affects the crops grown. The relieving features are, the almost general absence of sodium carbonate (washing soda) and comparatively high lime content of the soil. The methods adopted in Sind for reclaiming such lands are described below.

(1) *Mechanical methods* : For *kalar* soils which are more or less permeable, a process called '*Leaching and Cropping*' has been devised whereby the salts are leached down in the lower layers of soil by application of a large quantity of irrigation water amounting to 24 to 32 in. The land is then to be intensively cropped, otherwise it will revert to *kalar*, by the rise of those salts which have been leached down. A suitable rotation for such freshly reclaimed lands would be *guar* (green manure) —wheat and cotton.

(2) *Chemical methods* : Chemical correctives for toxic salts have been found effective. The best results have been obtained with calcium compounds, e.g. calcium chloride and calcium sulphate. They neutralize the effect of injurious salts on plant growth. But these chemical methods are rather expensive and their beneficial effects are temporary. However, they are useful in dealing with small persistent patches of *kalar*, as their action is rapid and definite.

(3) *Agronomical methods* : This consists of cropping the *kalar* land under a system of rotation which includes crops resistant to salts. A rotation which includes the rice crop can be successfully practised in the initial stage till the salts present in the surface crust are removed to the underlying sand layers. Such a rotation is practicable when sufficient water is available for rice cultivation. Once the land is reclaimed any other dry crop rotation can be practised. For the 'dry' lands, growing of *berseem* (*Trifolium alexandrum*) during *rabi* season has been found quite effective.

Maintenance of soil fertility : Under pre-Barrage conditions, no particular rotation was practised and the soil fertility was maintained by a system of fallows. But under the present system of intensive cultivation, the fallows will be reduced and the problem of maintenance of soil fertility will be more difficult. The main lines along which the problem is being investigated are :

(1) *Adoption of suitable rotations of crops* : Several rotations have been tried. Among them a three years' cycle rotation of, fallow—wheat—*matar* (*Lathyrus sativus*) green-manured cotton has been found to be the best. Other crop rotations in which *berseem* is the major crop have also been recommended for maintenance of soil fertility.

(2) *Addition of organic and inorganic manures* : The Sind soils are particularly deficient in the nitrogen and organic matter. The best form of organic matter is cattle manure (F.Y.M.),

but it is not available in sufficient quantities. Therefore, the Agricultural Department is advocating the addition of organic matter in the form of compost or green manure which would improve the physical and chemical properties of the soil and its fertility in general. Compost which is prepared from the organic material mixed with cattle dung and urine is quite high in its nitrogen content. The practice of green manuring is easy and does not involve much cost. The crops commonly grown for green manuring in Sind are, *guar* (*Cyamopsis psoralioides*) and sunn-hemp (*Crotalaria juncea*). To encourage the practice of green manuring the Government has given important concessions which benefit the cultivators.

Water requirements of crops

Under canal irrigation the problem falls under two groups, associated respectively with the safe delivery of water and with its optimum utilization. The Irrigation Department is concerned with the first item. The *hari* believes that more water brings him increased yield. This is far from being a fact. In an irrigated tract the economic and judicious utilization of water is of paramount importance if maximum production and soil hygiene are to be maintained. The Agricultural Department has been carrying on research to study the influence of varying water doses on the yields of crops and to determine the optimum amount and the time of application of water to the different crops. It has been found that the cotton crop which is the most important financial crop, has given very satisfactory results on a delta of 35 acres inches. It has also been found that there is no advantage in irrigating the cotton crop after mid-October but that more frequent irrigations during flowering are useful. Other *kharif* crops successfully mature on a delta of 21 to 27 acres inches, and their irrigation supply ceases by the end of September. Paddy gives normal yield with 70 in. delta. As regards *rabi* cultivation the water is available from 10 October and the delta for wheat and gram (*Cicer arietinum*) ranges between 14 to 17 acres inches.

Cropping system

Under the irrigation system, the sequence of cropping plays an important part and it has to be so arranged that the best use can be made of the water, man and bullock labour available. Due to the over-lapping of the harvesting of *rabi* crops and the sowing of *kharif* crops there is greater pressure on agricultural labour and on the irrigation supply during such periods. Another problem which is causing anxiety is the attainment of the *rabi* intensity of 54 per cent as designed under the Barrage project. The main difficulty has been that wheat, which is the important *rabi* crop, has a very limited period of sowing during which it is not possible to sow such large areas. As a result of investigations the Agricultural Department recommends the cultivation of *rabi* oilseeds, which possess a wide range of sowings, and by their inclusion in the cropping system the sowing period can be extended to three months. These oilseeds are sown and harvested at different periods and, therefore, they allow a better spread-over than is possible with wheat. The important *rabi* oilseeds are the *Brassicae*, consisting of *toria* (Brassica campestris L. *var toria*), *jambho* (Eruca sativa L.), rape-seed (Brassica campestris L. *var sarson*) and mustard (Brassica juncea *kars*). Efforts are also being made to extend cultivation of linseed which has been found to grow successfully under Sind conditions.

Scope for development

It is true that it is on account of the new system of perennial irrigation that the province of Sind, which was formerly threatened by famines, is in a very favourable position today. During these days of war and scarcity of food, it is not only self-sufficent in food production, but is one of the very few 'surplus' provinces and is supplying large quantities of wheat and rice to other major provinces.

CULTIVATED AND UNCULTIVATED AREA IN SIND DURING 1940–1941

Details			Area in acres
A. total Cultivated	Net area sown	5,370,000	10,282,000
	Current fallows	4,912,000	
B. Culturable waste	..	..	8,031,000
C. Not available for cultivation	Forests	725,000	11,873,000
	Others	11,148,000	
Total area	..	..	30,186,000

During the current year production will be higher due to extensive propaganda in connection with the 'grow more food' campaign. There is, however, great scope for extension of the areas under the various crops as large areas are still lying uncultivated as may be seen from the table given above.

The above table reveals the striking fact that about 8 million acres of culturable land are still available. From the total cultivated area of 5·4 million acres, about 1·5 million acres are irrigated by inundation canals in the upper and the lower regions of Sind where the Barrage water cannot reach, 3·4 million acres is *barrani* area cultivated by rain-water and the remaining 3·2 million acres are irrigated by the Barrage canals while the canals are capable of irrigating about 6 million acres. There is water available, therefore, for about 2·5 million acres more. It would appear strange that when we have the water, such a vast area, which is nearly 45 per cent of the culturable area, is lying idle. The main difficulty is that of agricultural labour. Sind is a comparatively thinly populated province with a density of 94 per square mile as compared to 742 of Bengal and 573 of Bihar. There is, therefore, a good scope for mechanical cultivation. The Agricultural Department is already advocating time-saving implements and improved methods of cultivation. But in dealing with such large areas, it is necessary that enterprising economists and landlords should join hands with the Government in starting large estate farms which will be cultivated by mechanical means under the supervision of experts. There is good scope for such a scheme and this is the proper time when it should be launched for producing more food for the starving millions of India.

PLOWLESS FARMING

PLOWLESS farming is not a new idea as there are many farms in Western Canada on which a furrow has not been turned in years, says G. E. DeLong, Dominion Experimental Station, Lacombe, Alberta.

This does not mean that the plow is becoming obsolete. There are conditions of soil and climate where the plow will prepare a seed bed cheaper and more efficiently than any shallow tillage implement. Furthermore it has been demonstrated that on certain soil types plowed land which is not worked down and left in the rough is more resistant to soil drifting than that receiving any other cultural treatment. On the other hand, plowless farming under certain soil and climatic conditions may be possible and advisable where exclusive grain growing is practised.

Records compiled at the Dominion Experimental Station, Lacombe, show that shallow tillage will reduce the cost of summerfallowing by one-half and at the same time more efficiently control most of the annual and perennial weeds. Shallow tillage or Plowless farming has also shown its value in the case of crops grown on stubble land. Experience has shown that, where it is possible to work stubble land with shallow tillage implements in such a way that two to three crops of weeds are germinated and destroyed before the crop is seeded, cleaner and better crops are produced than if the plow is used in preparing the seed bed.

Circumstances may occur in Central Alberta which make it impossible to follow shallow tillage and delayed seedling of an early maturing variety. A late spring may make it impossible to shallow till the land before seeding. Under such conditions, the plow has proved to be the best implement to use in preparing stubble land for a grain crop.

There are arguments both for and against plowless farming. Many farmers have tried plowless farming and are going back to the plow. Shallow tillage and plowless farming have proved best in the drier areas of the prairies, and their use is gradually increasing in areas favoured with more liberal rainfall. It is doubtful, however, if the plow will ever be discarded in areas having sufficient rainfall to produce forage crops and where sod has to be broken. The plow is still an essential implement in a diversified farming programme.—*Department of Agriculture*, Canada.

METEOROLOGY AND AGRICULTURE[1]

By E. F. Sykes

The Bundi Agricultural Syndicate, Alphanagar, Kotah

It is a good sign that the Meteorological Department is taking an interest in the agricultural aspects of their profession. Our present purpose is to examine the case from the agricultural point of view.

Speaking first of the article we are considering. If Mr Gupta will draw on the chart of the progress of the monsoon according to our rain-guage the curve showing the mean rainfall at Kotah, (which is one of his recording stations, and from only 10 miles distant and similarly situated, a long term point of view would reveal it a little different from our own climate[2]). It will be possible to compare the generalized charts in the article with the very individual one of our records. But even without that we can make some observations on the utility of averages. Our chart shows three great skyscrapers, two in July and one towards the end of August. But on page 23 North-West India and Gujarat (which is presumably *us*) shows a crisis between 8 and 12 July, but nothing above 0·7 of an in. While our crisis of 22 August is passed over quite lightly, it is evident from the flood chart that in the neighbourhood there was even heavier rain than at our rain-gauge. We must regretfully admit that even as recorded history these averages over so wide an area mean nothing to us. Of course this is nothing new, and in rainfall the average is probably more meaningless than in any other department. We, for example, have an average variously reported at 24 or 27 in. But as this is based on falls varying from 8 in. to 48 in. the value of the average is not great even if considered with the frequency distribution. Popular opinion makes light of averages.

Everyone who tills the ground knows that distribution rather than actual volume is the important factor. When we come to the table on p. 22 we find a closer resemblance, as the area covered is much less. Taking the East Rajputana table, we see the August crisis well marked out but the double crisis of July marked but faintly. The figure of 12 in. for East Rajputana on 3 June looks very attractive, but we were quite dry, and it may only mean that instead of five cents there were ten. This table without the actuals does not mean much.

Theory vs. experience

To ascertain what we ought to ask from the meteorologists, let us examine our own experience in relation to the rainfall. In the first place we might observe that in many cases the rainfall of any one year cannot be considered without taking into account that of the previous year. This specially concerns tank irrigators like ourselves but it may equally concern well cultivators, especially those who labour to irrigate cane from their wells. With us the consideration is paramount. All our troubles, the conversion of what should have been a bumper season into a disaster, from which we were retrieved by the accidental coincidence of rising prices, have arisen from the fact that 1939 and 1941 were famine years and so the nursery sowing season found us with a dry tank. If 1939 drove us out of cane, 1941 nearly drove us out of rice.

The chart for June is interesting if the rain-chart is compared with the tank-gauge. The petty rainfalls of 14 and 20 June were evidently local thunderstorms. On the other hand the rain of 23rd was heavier elsewhere and widespread as the tank-gauge promptly went up to 5 ft. Of course, the lower levels do not hold a great volume of water. But the 5 ft. we found on the 24th was enough to set us confidently to sowing nurseries. Which we, of course did, beginning on the 27th and sowing serially to conform to our expected rate of transplantation. Meanwhile we had to wait for the nurseries. This year we had extended our area by 33½ per cent (grow more food) and through the medium of Indian Farming, having become acquainted with the valuable trials made by Nagina on fallowing vs. leguminous recuperation, we had heavily fallowed the whole area. And it proved highly productive, but not to

[1] (This is an interesting commentary on the place of Metereology in Agriculture and has been inspired by an article entitled 'Monsoon of 1942' in Vol. IV, No. 1 of Indian Farming. It is expected to provoke equally interesting comments from the contrary point of view.–Ed.)

[2] The curious reader will find an account of our concern in Indian Farming, Vol. III, No. 3.

rice of which the transplantation could not possibly begin till about 20 July. Meanwhile the rainfall chart shows what was happening. By 13 July the tank was full and overflowing, and the rivers on either side in flood, so that we were restricted to the labour available in the villages within our Doaba. The land, divided off into *kiaras* was naturally a series of ponds, in which no labour except wet ploughing and *sohaguing* for rice (for which the time had not come) was possible. But the excellent culture was very profitable to grass in the areas not previously under rice and in the other areas to rice from the previous crop that even the gleaners had missed and the *sarus*, our increasing pest. The effect of the growth of the grass has already been described: from the start it proved a great hindrance to transplantation. The rice, on the other hand, with its thin blades, looked harmless, but was very deceptive, for before it could be got at, it had formed stools which were more troublesome than the grass. In some places it had all the appearance of a good crop, and by way of experiment we allowed it to mature, in one of which experiments over a whole square of 25 acres it yielded a crop of 12 mds. of paddy per acre, field measurement. We only wished we had left more to mature, instead of wrestling with it in the field, for knowing that no *rabi* crop would be of much good in comparison we carried on transplantation to an incredibly late period, with effects that can be imagined. However, if bought wit is better than taught wit, we had our money's worth, for we know what no one could have taught us, (for rice has not previously been grown seriously in this area or in any large bulk), the very latest date up to which it is possible and desirable to transplant rice.

Is Meteorology of any assistance?

This leads to the consideration that without water in the tank to plant nurseries in May, our area must be very limited, and that therefore any expenditure is justified to save up water in good years in the tank for use in bad ones and therefore for raising the full tank level. All this is rather by the way, but as we have previously given very candidly an account of our early trials and errors, it is not unreasonable to continue. But it has also a bearing on the strict purpose of this article and that is to give a complete account of one year, so that not only we but our readers can judge of the assistance we could have received from the Meteorological Department, as at present constituted, and what might possibly be received from a department specially constituted for the purpose. We must admit that the answer to both these questions, at the first glance is 'none at all'. But such a want of faith in science is not to be accepted without further examination, and if the present writer has no luck, one of his readers perhaps may be more fortunate.

Consider each of our troubles and how they might have been forecasted and prevented. It would be working backwards to foretell the drought of 1941, with the consequential empty tank of 1942. It would have been an advantage to know that the tank would fill 5 ft. by 15 June but (i) it didn't and (ii) no known method of forecasting would have informed us—obviously as such small events vary widely over short distances. We have known 4 in. of rain at Kotah (10 miles away) while our gauge recorded nothing. Similarly we should have liked to know that no rain in excess of 2 in. at a time would fall in a single day, and that each rainy day would be followed by three rainless days, or even what actually occurred, viz. a break from 4 to 16 August. Above all we would have liked to know that the rains were to shut down with a click on 3 September—or rather we would have liked to know that there would be regular rain in September—which there wasn't—with conspicuous results to the *rabi*, especially on the *barani* areas. This defect of September rains is one of the worst climatic features of this area. Its effect on green manuring, so successful elsewhere, is obvious. Some years, of course, are exceptions but can they be forecasted?

Conclusion

No. Regretfully we come to the conclusion that at present no help can be expected from the forecasts of Meteorological Department in agricultural matters, but hope is not abandoned, and these arguments, with all their defects, are laid before readers in the hope that someone will point out the right path.

GLANDERS IN INDIA

By S. K. Chawdhury, G.B.V.C.

Officiating Assistant Research Officer, Imperial Veterinary Research Institute, Izatnagar

GLANDERS chiefly affects the horse tribe and has a wide distribution in India. The donkey is highly susceptible, the disease usually developing in an acute form. The mule is slightly less susceptible but the course of the disease is generally rapid. The horse is much less susceptible and the disease usually runs a chronic course and some horses may even show apparent recovery. Man may acquire the disease which usually takes an acute course with fatal termination. The cat tribe is also highly susceptible and zoo animals may acquire infection through eating the flesh of glandered animals. Cattle are refractory.

Causes of the disease

The prime cause of the disease is a bacillus known as 'Pfeifferella mallei'. In infected animals this organism is found chiefly in lungs, nasal mucous membrane, submaxillary glands and secondarily in bones, skin and internal organs such as spleen, liver, etc. The organism is a strict tissue parasite. The lesions are fairly typical. The predisposing causes are bad feeding, over-work and other debilitating factors. Age has a decided influence on susceptibility, old horses being more resistant.

Mode of infection : There are three ways by which infection is transmitted from diseased to healthy animals.

(1) Through inhalation of the stable air contaminated by glandered animals.

(2) Through the digestive tract by contaminated food and water.

(3) Through the skin by infected grooming tools, clothings, harness, sponges, etc.

Infection by ingestion is the most usual, the disease being most probably spread at least from common drinking troughs in the case of town horses, such as *tonga* ponies. The incubation period varies roughly from a week to a month and may be more.

Incidence

Very little is known of the real extent of the incidence of glanders in India. It is believed to be not infrequent in tonga ponies and other town horses, which are more likely to be exposed to infection than country horses. Sudden outbreak of glanders may however occur in any concentration of horses due to the unsuspected presence of an affected animal.

Symptoms

Three forms of glanders, viz. pulmonary, nasal and cutaneous (farcy) are usually recognized. One or more of these forms may frequently occur in the same animal.

The earliest sign is usually nasal discharge, most commonly unilateral, with swelling of the lymph glands situated under the jaw. These glands become hard and so immovable as to appear fixed to the jaw bone. The nasal discharge is at first somewhat watery and later becomes purulent, and often persistent as the infection spreads from the nasal membrane to the adjoining air sinuses enclosed by the bones of the face. It is needless to add that the discharge is highly infectious; if the nasal membrances be examined, ragged ulcers with a yellowish or bleeding base may be seen. Occasionally, some evidence of healing may be seen and the scars have a peculiar 'stellate' appearance. The animals so affected show signs of wasting and possibly intermittent fever.

The pulmonary form is produced by the passage of virulent glanders bacilli from the digestive tract to the lungs, by way of the blood or lymph streams. During this transient invasion of the blood or lymph stream, the organisms frequently settle down in sites other than the lung, viz. bones, spleen, liver and even brain. The development of symptoms depends on several factors, such as, the degree and virulence of the infection and the natural resistance of the animal which depends to a certain extent on how the animal is fed, worked and generally looked after. Quite frequently, the invasion of the lung pulp is marked by the formation of small nodules which may be very scanty or quite numerous. These foci of infection may be rendered inert through slow calcification and an animal so affected may live for years without showing obvious symptoms. On the other hand, the resistance of the lungs to the infection may be so poor that severe

pneumonia may develop leading to early death. Between these two extremes exist grades of pulmonary affection. The commonest form is probably a subacute broncho-pneumonia which is always liable to flare up, often with a fatal result, under depressing influences such as chill, overwork, poor feeding, etc. whilst a dose of mallein commonly precipitates an acute and fatal attack of pneumonia in such cases.

The third form of glanders, called 'farcy', affects the skin and its underlying lymph vessels. It is usually the result of a blood or lymph stream spread but may also develop from direct contact with similarly diseased animals, or, more frequently, through infected grooming tools, harness, clothing, etc. In farcy, small nodules (farcy buds) develop within the skin, usually near the fetlock. These are at first hard, but soften as they ripen and exude a clear sticky matter through a small opening on the surface. Later, the nodules burst and discharge pus. The ulcers thus formed have irregular, somewhat eroded margins and bleed readily but they heal up fairly soon, leaving typical scars. One or more of these nodules may develop at the same time or in successive crops and shortly, there is evidence of involvement of the lymph vessels of the skin and the subcutis. These vessels become abnormally prominent and 'corded' and fresh crops of nodules develop along their course. Inflammation of these vessels takes place and fluid from them pours into the subcutaneous tissues so that the affected area becomes markedly swollen. In an advanced stage of the disease, the entire limb is swollen and the skin extensively ulcerated, as adjacent ulcers coalesce. The hind limbs are generally affected (rarely the fore limbs) but nodules and ulcers may, by lymphatic spread, appear on any part of the body. The acute phase of the disease is accompanied by fever and loss of appetite and later by profound emaciation. An affected animal is soon rendered worthless.

Diagnosis

Glanders may be suspected when any of the symptoms described are evident. The existence of the disease must, however, be confirmed by the *mallein test* and in cases of positive reactions to this test by further post-morten examination. Mallein is prepared by growing the 'glanders bacillus' in a liquid nutrient (e.g. bacteriological broth) for a certain period at the end of which the organisms are filtered out. The filtrate (mallein) contains the toxins produced by the organisms during growth. This biological product may be used unaltered, for the subcutaneous mallein test or may be concentrated, for the more commonly employed intradermal palpebral test. In the subcutaneous test, the requisite dose of mallein is injected under the skin and the temperature recorded at stipulated intervals. High temperature and swelling at the site of inoculation indicate that the animal under test is affected with the disease. In the intradermal palpebral test, a drop of concentrated mallein is injected between the layers of the skin of the lower eye-lid. In positive reactions, the eye-lids swell, often so much that the eye is closed, and the animal evinces severe pain of the eye with lachrymation and, in many cases, inflammation of the delicate outer membrane of the eye-ball.

These tests can only be carried out by a qualified veterinary surgeon. In all cases, a proper post-mortem examination must be performed on positive reactors and the existence of specific lesions should be determined. In some cases, it is further necessary, where these lesions are not quite typical, to inoculate small laboratory animals like guinea pig with selected post-mortem materials, and finally to isolate the specific organisms by the use of specific bacteriological methods. It will be seen, then, that the correct diagnosis of glanders entails considerable field and laboratory experience.

Prevention and control

In India, the Glanders and Farcy Act No. XIII (1899) exists for the prevention and control of this disease. Local Governments have authorized the seizure of glandered animals within specified areas, and to put horses suspected to be glandered to any prescribed test. If any animal is declared to be affected with glanders, it is to be destroyed immediately and the shed, enclosure, fittings, feeding and watering troughs, etc. are to be disinfected according to the instructions of authorities. The owner of an animal suspected to be suffering from the disease must detain that animal as well as all horses in contact, and send immediate notification to the nearest veterinary officer. In case of violation of the Act, the owner shall be liable to be punished with a fine or imprisonment or both according to the gravity of the offence. In certain cases, owners are entitled to compensation for animals seized under the provisions of the Act.

This Act can only be effective if owners and

the veterinary officers cooperate with the authorities of the Local Government. Owners can do much to protect their own interest by annual routine mallein testing of all horses, mules, donkeys, etc. in their possession and by not purchasing any animal other than those declared by a competent veterinary surgeon to be free from glanders at the time of the sale. The use of common watering troughs and the purchase of second-hand stable gear should be scrupulously avoided. Broadly speaking, safety for the horse owner lies in close attention to these recommendations and in observance of the Glanders and Farcy Act (1899).

BRITAIN AIMS AT HIGH-CLASS LIVESTOCK

IN view of the mutual desire to increase trade in agricultural products between Canada and Great Britain on the one hand, and the expressed intention of the British Government to maintain a healthy well-developed agriculture after the war, the methods of this development in Britain have an interest to Canadian farmers, agricultural scientists, and exporters. Already, one of the results of the British decision has been a trend towards a greater demand for qualified veterinaries. To this end, a second report of the Committee of Veterinary Education in Great Britain has been tabled in the British House of Commons. In the report are many recommendations dealing with the expansion and reorganization of the veterinary service, due consideration being given to preventing the expansion likely to bring about unemployment in the ranks of the profession.

The gist of the recommendations is that all veterinary schools be parts of the Universities in the same sense as are most of the medical schools. Veterinary studies, asserts the report, must be given full University status, with the degree obtained being a registrable qualification. Provision for research in veterinary medicine, scholarships and bursaries, particularly for the children of small farmers smallholders, and agricultural workers in less favoured districts are suggested. Each University is asked to consider, according to its individual conditions, the establishment of a Faculty of Veterinary Medicine, and legislative provision in respect to veterinary education is outlined, the main idea being maintenance of high-class stock, which will obviate loss among the animals themselves and also in livestock products.

The training of a veterinarian, states the report, is like that of a medical man, a training in an art as well as in science. If degrees in veterinary science or veterinary medicine (by whichever name they may be called) are to be registrable to practise, the clients of the veterinary surgeon need to be assured both that his education in theory has been an adequate basis for his technique, and that he has been well trained in diagnosis and in practical work of surgery and obstetrics and of preventive and curative medicine.—*Department of Agriculture, Canada.*

FIGHTING *KHAPRA* IN THE PUNJAB

By KHAN A. RAHMAN, B.Sc., AGRI. (EDIN.), PH. D. (CANTAB.)
Government Entomologist, Punjab Agricultural College, Lyallpur

WHEAT is an essential article of food. Therefore, today, it is of prime importance that all possible measures should be taken to conserve it both for the Defence Forces and the civilian population. The Department of Cooperative Societies, Punjab, Lahore, purchased 40,000 tons of wheat during July-October 1942 and stored it against scarcity in 36 different towns and cities in the Punjab. This storage brought in its train the ubiquitous *khapra* which attacked the stored wheat, in some cases, up to the extent of 73 per cent. The control of *khapra* is thus the first and foremost concern of persons entrusted with long-term storage of large quantities of wheat. Fighting *khapra* in such large and widely distributed quantities of wheat, was a new experience which brought to light certain facts of practical importance, which will prove useful in the control of this pest.

Purchase and Storage of wheat

The Department of Cooperative Societies, Punjab, purchased wheat mostly from the 1942 crop directly from the markets through its own Wheat Purchase Supervisors, and stored it at 36 centres distributed all over the province. At these centres the Department rented private houses for the storage of wheat, the number of such rooms varying from 2 to 55 at each centre. The capacity of these rooms varied from 2,016 to 122,000 cubic ft. The godowns are scattered in different streets in each centre, 40 per cent of these being situated in the residential quarters.

The Cooperative Department had to work under very abnormal conditions. Factors arising out of price control and the limits imposed by the Government made it impossible to purchase during that part of the season which is most favourable for the storage of grain; in consequence much of the wheat had to be purchased from the godowns of the stockists after the monsoon started. And this wheat had to be weighed and shifted to the departmental godowns, often under unfavourable weather conditions. Again, owing to the war and the political situation, uncertainty of transport made it necessary to move large quantities of wheat from the purchasing to the consuming centres during the periods of high wagon priority, while monsoon conditions still prevailed. At the same time accommodation in the consuming centres had to be found at short notice and was often, as already mentioned, not very suitable for the purpose. Further the monsoon period was unusually prolonged and the conditions were very favourable to the growth and multiplication of *susri* and *khapra*.

The floors of the majority of these stores are *pucca* and their walls are plastered with cement or mud. In these rooms there are numerous cracks and crevices which afford winter quarters to *khapra*. Most of these stores lack proper ventilation.

Wheat is stored in these rooms either in new bags or loose in a heap. The bags are arranged in rows, and the storage capacity varies between 144 to 14,140 bags. For storing wheat loose in a heap, a room is filled up to the ceiling or up to the height of its door. In the former case the doorway is blocked by nailing wooden planks on the door-frame and wheat poured into the room through a 3 ft. × 3 ft. opening in the wall which is situated just near the ceiling. In the latter case, wheat is heaped up against the wall farthest from the entrance of the room and when the heap reaches the door a pile of bags filled with wheat is placed near the doorway to block it. In some places, e.g. Fazilka and Abohar *bhusa* is spread both on the floor and on the top of the heap.

Treatment of stores

Stores used by the Department of Cooperative Societies for the storage of wheat are either new (in the sense that wheat was never stored in them before) or old (in the sense that wheat, oilseeds, rice, etc. were previously stored in them). New stores were free from *khapra* while the old stores were infested with it. Prior to storage of wheat the old stores were superheated in June with charcoal at the rate of 7 seers of charcoal per 1,000 cubic ft. of space[1]. For 'heat

[1] For general information on the most important of these pests see my article entitled 'Save stored grains from insects' published in the INDIAN FARMING, Vol. IV, No. 1, January 1943, pp. 18–20.

treatment of empty store-rooms' see my article entitled 'Insect pests of stored grains in the Punjab and their Control'[1].

In a few of the stores which were superheated, there were numerous cracks and crevices in which *khapra* took shelter during superheating and reappeared and damaged wheat stored in them. The temperature of the room was raised above 150°F, but in the crevices this lethal temperature was evidently not attained. Investigations should be carried out to find (1) the temperature in the cracks when the room is above 150°F, and (2) the temperature to which the room should be exposed in order to develop lethal temperature in the cracks.

Insects found: The stores at Lahore, Fazilka, Abohar, Moga, Jagraon, Rawalpindi, Jhelum, Phullerwan, Bhalwal, Sargodha, Churkana, Sheikhupura, Gujranwala, Hafizabad, Sangla Hill, Chak Jhumra, Chichawatni, Gojra, Montgomery, Okara, Arifwala, Gurdaspur, Hoshiarpur, Ambala, Jullunder and Amritsar were examined during October-November, 1942 and the following insects were found in some or all of them: *khapra* (*Trogoderma khapra*), *susri* (*Rhizopertha dominica*), *sundwali susri* (*Sitophilus oryzae*), common grain moth (*Sitotroga cerealella*), the red flour-beetle (*Tribolium castaneum*), the saw-toothed grain beetle (*Oryzaephilus surinamensis*), the flat grain beetle (*Laemophloeus pusillus*), the black fungus beetle (*Alphitobius piceus*), tobacco beetle (*Lasioderma serricorne*), mites and psocids.

Susri was abundant at Fazilka, Moga, Hafizabad, Gurdaspur, Hoshiarpur, common at Lahore, Jagraon, Gujranwala, Amritsar and Jullundur, rare at Abohar and Sangla Hill and absent from other places.

Sundwali susri was abundant at Jagraon and Gurdaspur, common at Gujranwala, Hafizabad, Amritsar, Jullunder and Hoshiarpur, rare at Lahore, Moga, Rawalpindi and Jhelum and absent from other places.

Red flour-beetle was common at Lahore, Fazilka, Moga, Jagraon, rare at Abohar, Amritsar, Gurdaspur, Jullundur, Hoshiarpur and absent from other places.

Grain moth was common at Jagraon and Gujranwala, rare at Lahore and Hafizabad and absent from other places.

Saw-toothed grain beetle was rare at Fazilka, Lahore, Amritsar, Gurdaspur, Jullundur, Hoshiarpur and absent from other places.

[1] *Indian Journal of Agricultural Science*, Vol. XII, part IV, August 1942, pp. 564-587.

Black fungus beetle was common at Gurdaspur, rare at Lahore, Moga, Amritsar, Jullundur and Hoshiarpur and absent from other places.

Flat grain beetle was rare at Lahore, Moga, Amritsar, Gurdaspur, Jullundur, Hoshiarpur and absent from other places.

Tobacco beetle was rare at Lahore and absent from other places.

Mites and psocids were abundant at Lahore and Moga, common at Jagraon, Fazilka and absent from other places.

Percentage of attack

The stores were examined during October-November 1942 to find out the percentage of attack. The percentage of attack in the table given below denotes the percentage of grain showing signs of *khapra* attack in a sample which was taken from the top of the heap when wheat was stored loose and from all accessible bags when it was stored in bags. Since a number of stores were examined, the highest and lowest limits represent the range of insect attack at any particular centre.

Locality	Total quantity of wheat stored (md.)	No. of stores examined	No. of stores found free	Period of examination	Lowest percentage of attack in a store	Highest percentage of attack in a store
Sheikhupura	3774	2	—	Oct.	1·2	4·9
Amritsar	48047	2	1	Oct.	—	5·0
Abohar	19593	28	20	Nov.	0·7	7·3
Arifwala	82830	—	—	Nov.	1·0	5·0
Hafizabad	5031	5	—	Oct.	1·3	7·4
Gujranwala	14637	7	—	Nov.	1·2	9·3
Gojra	40700	20	—	Oct.	2·5	9·5
Jullundhar	17315	3	3	Nov.	4·1	11·3
Rawalpindi	77500	24	20	Nov.	8·9	12·3
Jhelum	62500	17	12	Nov.	7·1	12·9
Montgomery	82835	—	—	Nov.	2·5	13·0
Hoshiarpur	12529	6	—	Oct.	3·1	14·0
Bhalwal	15000	14	—	Nov.	8·4	17·3
Phullerwan	15500	12	2	Nov.	12·9	17·5
Sargodha	83701	55	—	Nov.	11·3	18·4
Chak Jhumra	4217	6	—	Nov.	10·3	21·8
Fazilka	67360	28	—	Nov.	4·7	30·0
Sangla Hill	2000	4	—	Nov.	2·4	32·0
Jagraon	26437	34	24	Nov.	13·7	38 5
Moga	7359	11	—	Nov.	10·4	55·1
Gurdaspur	3183	3	—	Oct.	3·2	73·0

It will be observed from the above table that in 14 out of 21 centres examined the attack of *khapra* was more than 10 per cent and in Gurdaspur it was as high as 73 per cent. It may be further mentioned that (1) wheat in most of the new stores escaped unharmed, and only a few new stores (which received infestation from adjoining stores, as at Moga,

or in which infested wheat was stored, as at Fazilka) developed a high percentage of damage, and (2) damage to wheat stored in old stores, particularly those which were not superheated, was usually high.

Infestation in relation to light

1. The trade is of opinion that wheat stored in dark godowns escapes damage from the pest. Observations were made on this point in godowns where wheat was stored loose and the results are presented in the table below :

Locality	Percentage of attack in: Partially lighted portions of a store	Dark portions of a store
Lahore	12·7	21·7
Amritsar	No attack	4·5
Hoshiarpur	3·1	11·4
Jullundur	5·4	8·7
Gurdaspur	16·3	73·0

But it will be seen from the above table that *khapra* infestation is higher in the dark portions of a store.

2. The population of *khapra* was also studied in lighted and dark portions of a heap of wheat in a store at Lahore in two sample tubes 2 in. × 1 in. containing 32 gm. of wheat. Results are given in the table below :

	Adults	Larvae
Lighted portion	26	54
Dark portion	325	423

It will be observed from the above table that population of *khapra* adults and larvae was much higher in the dark portions of a store.

Observations were also made on the percentage of attack of *khapra* on the fringes and centre of a wheat heap in a room. Results are summarized below :

(a) *In corners*: The attack of *khapra* on wheat ranged from 5 to 46·2 with an average of 17·4 per cent.

(b) *Along the walls*: The percentage ranged from 4 to 45·3 with an average of 15·4.

(c) *In the centre of the heap*: The infestation ranged from 1 to 17·3 with an average of 9·9 per cent.

(d) *Near the doorway*: Here the infestation ranged from nil to 18·4 with an average of 7·8 per cent.

Thus when wheat is stored loose in a heap *khapra* attack in it is highest in the corners and along the walls.

Hibernation: It was believed that in the Punjab *khapra* entered hibernation at the end of September or beginning of October but during the present fight it was found to be active up to the end of November in all the wheat stores in which wheat was stored. The temperature of the godowns above the grain heap was taken in October-November at 16 different centres and it was found to be between 73° and 83°F at Bhalwal, Sargodha, Abohar, 83° and 92°F at Gojra, Toba Tek Singh, Arifwala, Jhelum, Phullerwan, Hafizabad, Sangla Hill, Chak Jhumra, Fazilka, Jagraon and 92° and 100°F at Montgomery, Gujranwala and Moga. The pest was active in these stores at the time of recording the temperature.

Fumigation of infested stores: Reports of *khapra* damage were received from 24 centres in September, 1942. These godowns were inspected and only those seriously infested and not situated among the residential buildings were treated. Due to war CS_2 could not be obtained in sufficient quantities and at usual rates and for this reason it was only used at Lahore in a store containing 461 bags of wheat at the rate of 1 oz. per 15 cubic ft. The other stores were fumigated with HCN (prepared from 1 lb. of potassium cyanide, 1 lb. of sulphuric acid by weight and 3 lb. of water by pot method which is sufficient for 1,600 cubic ft. of space) and the exposure given was 48 to 72 hours. About 1,41,203 md. of wheat were thus treated at 15 centres and 80 to 90 per cent mortality among *khapra* was obtained. In places where fumigation was not possible gunny bags were spread over the heap and the pest which collected on them was destroyed in the manner described in my article referred to above[1].

Recommendations

In the light of the experience gained about *khapra* suggestions for the guidance of those engaged in the storage of wheat in order to minimize or prevent damage by this pest are given below :

1. Rooms rented for stocking wheat should (a) have cement or cement pointed floors and walls and ceiling plastered with cement or mud, (b) be capable of being made air-tight for

[1] At Jagraon gunny bags were spread over the infested gram and it was found that *Bruchus sp.* also clung to the bags in large numbers. *Bruchs sp.* are active insects. After several investigations rolling up gunny bags with the pests on and dipping them in boiling water were found to be the most effective way of destroying the pest.

fumigation, (c) preferably be away from residential quarters and (d) be well-ventilated. And the ventilators and sky-light, etc. should be well protected with fine wire gauze so as to prevent infestation from outside. A multiplicity of godowns in a centre should be avoided: efforts should be made to rent a few large-sized rooms rather than have a large number of small-sized rooms. When more than one room is to be used for storage of wheat the rooms should be near, preferably contiguous to each other.

2. The godowns should be thoroughly cleaned before storing wheat and old stores used for this purpose should be superheated. Chinks and cracks in these should be filled up with cement or lime paste, the latter being prepared by shaking quick-lime with a small quantity of water and applied when still hot. Joints in the doors, etc. should be made *khapra*-proof either by pasting strips of thick paper over them or by filling them up with mud.

3. Sound, healthy and fresh wheat should be purchased from the threshing floor and not wheat which has remained in a store for a period. It should be thoroughly dried before storage.

INSECT PARASITES AID IN WAR EFFORT

BIOLOGICAL control of insects—the science of utilizing the natural ememies of insects in controlling insect pests and reducing crop losses—has reached a high peak of importance in Canada through the work of the Dominion Parasite Laboratory at Belleville, Ont., maintained by the Division of Entomology, Dominion Department of Agriculture. The propagation and distribution of parasitic and predacious insects for the protection of food crops and forests have their centre at this Laboratory, and shipments of parasites are being made to all parts of Canada, and to Newfoundland, and upon occasion to the United States and abroad.

The work of the Laboratory has been highly successful and involves careful studies of the methods of production of the various natural enemies of the injurious insects of Canada, and intensive laboratory investigations of their behaviour under controlled conditions as well as under natural conditions in the field, the study of methods of distribution and surveys of their effectiveness in control. Parasites have been shipped from the Laboratory to aid in the control of spruce, larch, and pine sawflies, pine shoot moth, satin moth, codling moth, larch casebearer, oriental fruit moth, European corn borer, pea moth, pea weevil, the greenhouse whitefly, mealy bugs of different species, and other insects.

The whitefly, mealy bugs, and aphids are three of the pests of greenhouses or crops under grass, and in view of the expansion of greenhouse crops, the control of these pests is of increasing importance. The injurious effects of the whitefly are especially serious on tomatoes and cucumbers under glass. Millions of parasites are shipped from the Laboratory every year, and since the beginning of 1943 no fewer than more than 6,500,000 whitefly parasites have been distributed to greenhouse men for direct use in controlling these pests. The parasites are shipped on request, free of charge, in a non-active stage on the leaves of the food plant, and have been liberated successfully in all parts of Canada and Newfoundland. In 1942 several shipments were made to Hawaii, in answer to a request for breeding stock. The cost of producing tomatoes and cucumbers under glass where the parasites have been used has been considerably reduced.—*Department of Agriculture*, Canada.

KANKREJ HUSBANDMEN OF GUJARAT

By M. D. Patel and C. N. Dave

Institute of Agriculture, Anand

BHARWADS and Rabaris are the two Hindu communities about three-fourth of a million in strength who are nomadic pastorals mainly devoted to grazing and raising of Kankrej animals in Gujarat and Gir animals in Kathiawar. Some of them are engaged in the rearing of sheep and goats, and a few in buffaloes and camels. This pen sketch deals with the Bharwads and Rabaris of Gujarat with reference to their hereditary occupation of breeding the Kankrej animals. Except in religious and some social matters they are alike in many respects and hence are treated as one. However, wherever desirable, the differences between them have been pointed out.

Home of famous breeds

North Gujarat is the original home of the famous breed of cattle known as Kankrej. The name of the breed is derived from the Kankrej Taluka or Pargana in the Palanpur State. Less commonly the breed is also known as *Wadhiar* or *Bannai*, from the Wadhiar Pargana adjoining the Kankrej tract or from the river Banas running through the Kankrej tract. The territorial expanse north of Kadi and Kalol in Baroda State up to Deesa beyond Palanpur, and from the foothills of Arasur up to Radhanpur and Banaskantha Agency in the west, abounds in grasslands rich in pasturage, and being traversed by the Banas, the Saraswati, and the Hathamati rivers providing ample fresh and clean water all the year round, is a congenial place for raising this long-legged, swift and powerful, but a little temperamental Kankrej breed of animals particularly for draft qualities required for pulling the load on the roads or in the arable fields. It is from this tract that the good quality bullocks are supplied to Gujarat cultivators by the Rabari and Bharwad herdsmen who tend and raise these animals. Bharwads and Rabaris among others are the main professional breeders of Kankrej cattle in North Gujarat.

Bharwads and Rabaris in itinerary

Bharwads and Rabaris are itinerant graziers. They have little land of their own for maintaining their herds. They take their adult stock from place to place in search of foraging for their animals, keeping generally the milking stock at home to be looked after by the women-folk and young children. In years of scanty rainfall when the growth of natural vegetation in the Kankrej tract is poor, they move with their family and with their stock to the south of Mehsana where soils are deep and fertile and rainfall less uncertain. In their itinerary they take the grasslands on lease for short terms and pay the owners in cash for the herbage. They are aware that cattle-stocking in a particular area enriches the land by the dung and urine voided on it by the grazing animals particularly at night when they fold and fix the rental of the grassland on that basis taking into consideration the number of heads to be grazed.

They take the articles of barest necessity with them while moving from place to place. A white canvas tent with wooden pegs, household utensils and vessels for cooking and eating the food in, grinding mill-stones, and water-jug together with their personal clothing, are carried by them on the backs of inferior bulls known as *Pothia*. During their journey, experience has taught them to carry raised wooden bedsteads woven with goat hair or woollen string. They do not sleep on the ground as there is the danger of bites from the snakes, scorpions, centipedes or other creatures very commonly found in the grasslands. The necessary food grains required by them are purchased from a nearby market place.

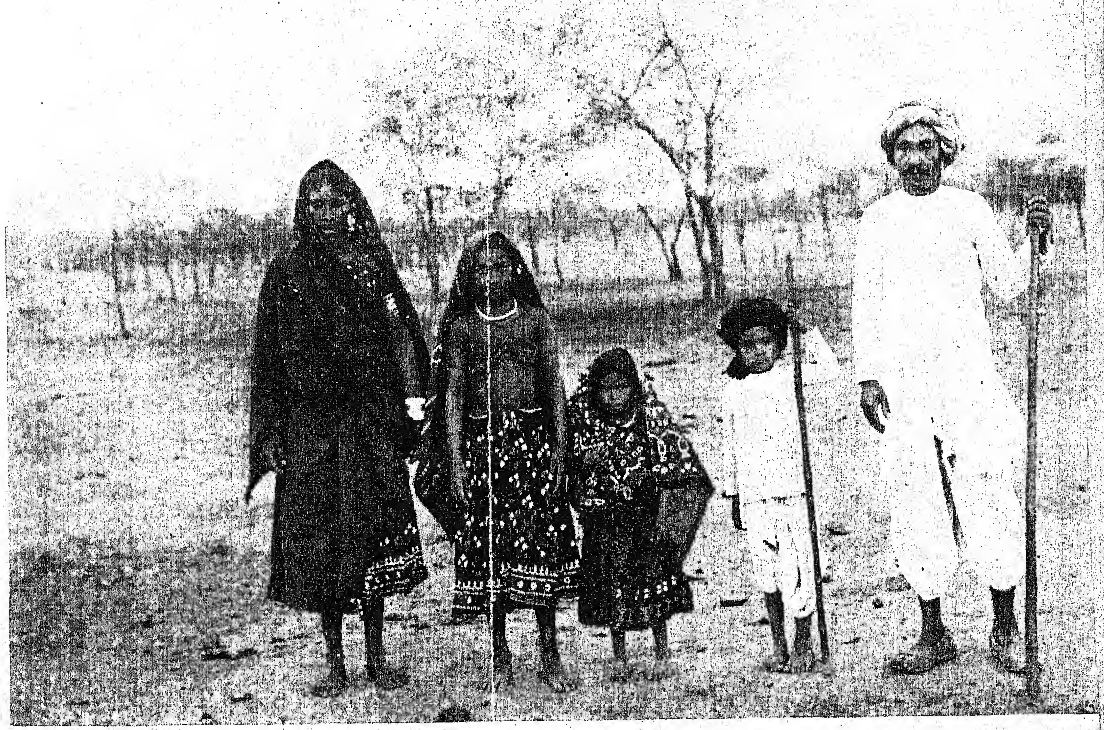
A watchdog is a constant companion with the Bharwad and Rabari herdsmen wherever they go. The dog is trained from its young age to look after the herd and watch the camping grounds against the ingress of thieves and pilferers of animals. In this task the dog is faithful to his master who feeds him and cares for him like one of his bovine companions.

Duties of home-folk

A Bharwad or Rabari boy begins his career as a cowboy. He drives the animals to the drinking place, a nearby stream or a pond. He learns to tie and untie the milking animals and thus to handle them and controls them

A typical Bharwad family

PLATE 27



A typical Rabari family

KANKREJ HUSBANDMEN OF GUJARAT

By M. D. Patel and C. N. Dave
Institute of Agriculture, Anand

BHARWADS and Rabaris are the two Hindu communities about three-fourth of a million in strength who are nomadic pastorals mainly devoted to grazing and raising of Kankrej animals in Gujarat and Gir animals in Kathiawar. Some of them are engaged in the rearing of sheep and goats, and a few in buffaloes and camels. This pen sketch deals with the Bharwads and Rabaris of Gujarat with reference to their hereditary occupation of breeding the Kankrej animals. Except in religious and some social matters they are alike in many respects and hence are treated as one. However, wherever desirable, the differences between them have been pointed out.

Home of famous breeds

North Gujarat is the original home of the famous breed of cattle known as Kankrej. The name of the breed is derived from the Kankrej Taluka or Pargana in the Palanpur State. Less commonly the breed is also known as *Wadhiar* or *Bannai*, from the Wadhiar Pargana adjoining the Kankrej tract or from the river Banas running through the Kankrej tract. The territorial expanse north of Kadi and Kalol in Baroda State up to Deesa beyond Palanpur, and from the foothills of Arasur up to Radhanpur and Banaskantha Agency in the west, abounds in grasslands rich in pasturage, and being traversed by the Banas, the Saraswati, and the Hathamati rivers providing ample fresh and clean water all the year round, is a congenial place for raising this long-legged, swift and powerful, but a little temperamental Kankrej breed of animals particularly for draft qualities required for pulling the load on the roads or in the arable fields. It is from this tract that the good quality bullocks are supplied to Gujarat cultivators by the Rabari and Bharwad herdsmen who tend and raise these animals. Bharwads and Rabaris among others are the main professional breeders of Kankrej cattle in North Gujarat.

Bharwads and Rabaris in itinerary

Bharwads and Rabaris are itinerant graziers. They have little land of their own for maintaining their herds. They take their adult stock from place to place in search of foraging for their animals, keeping generally the milking stock at home to be looked after by the women-folk and young children. In years of scanty rainfall when the growth of natural vegetation in the Kankrej tract is poor, they move with their family and with their stock to the south of Mehsana where soils are deep and fertile and rainfall less uncertain. In their itinerary they take the grasslands on lease for short terms and pay the owners in cash for the herbage. They are aware that cattle-stocking in a particular area enriches the land by the dung and urine voided on it by the grazing animals particularly at night when they fold and fix the rental of the grassland on that basis taking into consideration the number of heads to be grazed.

They take the articles of barest necessity with them while moving from place to place. A white canvas tent with wooden pegs, household utensils and vessels for cooking and eating the food in, grinding mill-stones, and water-jug together with their personal clothing, are carried by them on the backs of inferior bulls known as *Pothia*. During their journey, experience has taught them to carry raised wooden bed-steads woven with goat hair or woollen string. They do not sleep on the ground as there is the danger of bites from the snakes, scorpions, centipedes or other creatures very commonly found in the grasslands. The necessary food grains required by them are purchased from a nearby market place.

A watchdog is a constant companion with the Bharwad and Rabari herdsmen wherever they go. The dog is trained from its young age to look after the herd and watch the camping grounds against the ingress of thieves and pilferers of animals. In this task the dog is faithful to his master who feeds him and cares for him like one of his bovine companions.

Duties of home-folk

A Bharwad or Rabari boy begins his career as a cowboy. He drives the animals to the drinking place, a nearby stream or a pond. He learns to tie and untie the milking animals and thus to handle them and controls them

A typical Bharwad family

PLATE 27

A typical Rabari family

A Bharwad bridegroom.
All dolled up for marriage

A view of Bharwad dwelling
house with cattle paddock

PLATE 28

with a bamboo stick in his hand while his mother would milk the cows. To him herding and husbanding the animals is a professional calling, and when he grows up to manhood it becomes a professional career.

He has not received systematic education in the school. Illiteracy is very widespread among the Bharwads and Rabaris. But he learns the essentials of counting and calculating from his routine work. Even though he does not possess the knowledge of reading and writing, he is able to count the number of animal heads in his herd, and calculate the milk yield and prices realized from it. The disposal of milk and ghee and the purchase of food grains, cattle feed and clothes are done by the women. In this way through practice and experience a working knowledge of counting and calculating is acquired by the males and females of both the communities.

A Bharwad or Rabari loves his animals very much. If a cow gives birth to a calf on the way, he will carry the young on his shoulders to the place of his residence or the camp. He will wash the youngster, keep it clean and provide a grassy bed to it. He bestows his care to the mother of the calf also. All his bovine companions are known to him by their names, and he identifies them by peculiarities of their body marks or traits, or by their parentage. He often talks of birth-marks and body defects in his animals.

Home and diet

In North Gujarat, the Bharwads and Rabaris live in separate communities usually at one end of the village. Their settlements are known as *Nesdas*. Each herdsman has a house attached to which are the paddocks with fences of thorns to aggregate the animals at night. His house is usually of mud plastered walls with local country tiles on the roof. In the front room of the house guests are received and accommodated especially during rainy days. The inner room lacks in windows and consequently is dark and ill-ventilated. It serves as a store, kitchen and sleeping room particularly for the females.

His household kit is an assemblage of earthenware pots with a few vessels of brass and copper. In a corner of the inner room are placed the grinding stones which are used daily or on alternate days by the housewife for grinding the corn. A couple of bedsteads, thin tattered mattresses, earthen jars to keep the drinking water and a large earthen pot called *goli* with a churning rod for butter making are the humble furnishings of his dwelling place.

Their usual food consists of *bajra* or *jowar chapatis*, milk, butter-milk, and onions as vegetables. They take their food thrice during the day, morning, noon and evening. The breakfast or *chhaspiva* consists of bread and milk or butter-milk. The afternoon lunch or *randho* comprises of *bajra* or *jowar* flour boiled in butter-milk commonly known as bhadku or *ghesh*. In the evening meal or *valu*, they take *khichari* prepared from rice and split-tur dal, or bread. Tea is a very common drink among them. It is sweetened with *gur* instead of sugar.

Physique and personal adornment

The males are of medium size, heavily built with coarse skin and sturdy expressions. Their usual dress consists of thick *dhoti* or *pichhodi*, a waist-coat or *kediu or bandi*, a turban on the head, and a woollen blanket on the shoulders. Young men are colourful and dress themselves in green, red and blue. Silver or gold ornaments decorate various parts of their body such as neck, wrist, waist, fingers and earlobe.

The females are medium sized and strong built, square-shouldered, with a flowing stride of walk. They dress themselves in heavily plaited petticoat, bodice or brazier, and an overall *chundri* with coloured designs woven on it. Up to the age of motherhood of two children, they put on woollen dress, a *tangalia* over the waist and *chidiu* as a head dress. Small circular mirrors are embedded on the *chidiu*. They profusely decorate their wrists, neck, ears, legs as will be seen from the photographs. They are fond of tattooing their person with a locally available vegetable dye.

One can tell apart a Rabari male from a Bharwad by the number of *kas* or tying strings attached to the waistcoat. A Rabari has only one tying string on his *bandi* whereas the Bharwad has three such strings to tighten his *bandi*.

Bharwad marriage customs

Bharwad marriages are group marriages, and are held once in 12 to 13 or even 25 years on a day in the month of *Vaishakha* (May) as fixed by the astrologer. On this day all children varying in age from 35 days to 25 years are married. The richest Bharwad who has to give away his daughter in marriage buys a large

piece of ground where marriages are celebrated. A large number of marriage parties with bride or bridegroom come in bullock-drawn carts to the leader's place. A pandal is constructed for this purpose, in front of which is planted a carved totem pole (*Manek-stambh*) prepared from the wood of *Khijuda* tree (*Prosopis spicigera*) for which the Bharwads pay a large sum to the owner of the tree and the carpenter who shapes the pole with a series of grotesque mythical figures on all its four panels. Two of these figures are *Mahiaris* or milk-maids. On the top of the post is shaped into figure the Goddess Mata Bhavani, for the Bharwads are the followers of Mata Bhavani.

Money required to perform the marriage ceremonies and to feed and entertain the marriage parties is raised by a fixed subscription from each bridegroom party. Food is the costliest item in the whole affair. Rice, pulses, ghee, *gur*, tea, sugar and spices are lavishly consumed and lamentably wasted. Due to such wasteful customs, the Bharwads are not financially well-off. On occasions like marriage, all their lifelong accumulations of money are spent up.

Each couple goes to the *manek-stambh* or the marriage-post, bows to the Goddess, and gets the blessings of the chief priest. The couple is then received by the hostess or the wife of the leader selected for that occasion. She shows to them a miniature plough, arrow and a churning-rod, symbolic of their profession. The plough shows that they must have been tilling the land once.

The marriage ceremony lasts for three or four days. During this period the females form groups of their friends, sing and dance with graceful movements of wrist, hands and waist moved by the rhythmic beating of the drum. The males also form their own groups and perform *dandia ras* in circular movements. The merry-making results in throwing *gulal* powder on each other in a frolicsome mood.

To ensure that his daughter does not suffer from basic wants at her husband's place, the Bharwad father gives her ample clothing, and cash money to her father-in-law. He also gives at least five cows and up to a maximum of 16 animals – 15 cows and 1 bull – to his daughter. This gift is called '*Sol sundu*'. This forms a newly married Bharwad couple's nucleus herd.

The custom has ordained that the site where marriages have been performed cannot again be used for a similar purpose. It is converted into a pasture land with the marriage-post standing in it to indicate that it was used as a site for marriages in the past.

Unlike Bharwads, Rabari marriages take place in any year. They marry at an advanced age of 15 to 18 years. The marriage is held at the house of the girl's father who entertains the party for four to six days. Clothes and a few ornaments are given to the bride as marriage gift.

Social and religious practices

Polygamy, widow remarriage and divorce are permissible in both the communities. Upon the death of her first husband, the girl usually marries the younger brother of her husband even though he may be ten to fifteen years younger than her. Divorce is socially sanctioned upon the payment of a fixed sum of money in charity as desired by the community leaders.

The Bharwads are the followers of Mata Bhavani. *Navratris* (nine nights) in the month of *Ashvin* in September-October are considered as very sacred days. During these days they observe vigilance and fast and sing sacred songs. The Rabaris belong to Bijmargi, Ramanandi or Pirana sects. Their priests are Sompura Brahmins. The chief religious place of the Rabaris is Dudhrej near the city of Wadhwan in Kathiawar where annual fair is held during the sacred days of *Shivratri*, *Gokulashtami* and *Holi*. During these festivals they dance and sing songs and bhajans and forget their daily worries.

Knowledge of industry

The main source of income of the cattle breeders is by the sale of dairy produce and surplus animals. They sell the young male stock. The female calves are usually maintained. The best animals are retained by the Bharwad and Rabari herdsmen for breeding purposes. The breeders are very particular and clever in the selection of breeding bulls though their selection is based mostly on phenotypic appearences and marks on the body. They know the art of animal husbandry and the practice of animal breeding. In the amelioration of the professional status of the Bharwads and Rabaris lies a great promise of improving the Kankrej cattle wealth of Gujarat.

AFRICAN RUBBER VINE

CRYPTOSTEGIA GRANDIFLORA, the African rubber vine, is now engaging the attention of the scientists both in this country and elsewhere, as a wartime source of vegetable rubber. It is a quick growing perennial shrub, capable of yielding rubber the same year it is planted. It is easily propagated through seed and can be raised on extensive areas within a short time, and as such is eminently suited to be grown as a short-term rubber crop.

Tapping for latex is a very expensive item in the production of rubber from this plant. Though the whole plant is latescent, tapping cannot be done economically from all parts of the plant owing to many practical difficulties that are encountered during this operation. Direct bleeding by cutting the ends of tender branches is the only method so far known to be suitable for collecting latex from this plant. The plant produces two types of vegetative branches, the leafy and the comparatively leafless. The leafy branches are thinner, have shorter internodes and bear an abundance of foliage. They grow in all directions and give the characteristic bushy growth to the plant. The leafless shoots are stouter, more vigorous growing and have longer internodes. They grow erect and appear as though in search of some support to climb on. These shoots, otherwise called whips, tentacles or water shoots, are very rich in latex and are the best parts of the plant suited for tapping. Any successful attempt at inducing the production of large number of these whips on the plant will increase the amount of latex that is obtained by tapping and will go a long way in reducing the cost of production of rubber. With this end in view, several pruning trials were conducted at the Agricultural Research Institute, Coimbatore, on one year old plants and the reaction of the plants to pruning with special reference to the production and growth of whip shoots was studied. The experiments were started in October during the north-east monsoon period when conditions for regrowth were optimum. Six plants were selected for each system of pruning and their average measurements were recorded. Before pruning, these plants had on an average four whip and 23 leafy shoots per plant (shoots measuring less than 6 in. in length being omitted). Observations and measurements were done for two months from the date of pruning. The results are tabulated below :

System of pruning	Average new growth per plant			
	Whip Shoots		*Leafy Shoots*	
	Number produced	Average lengh in in.	Number produced	Average length in in.
1. Coppicing, i.e. pruning down to about 4 in. from the ground level.	1	108	8	25
2. Do. Leaving a leafy vegetative shoot alone.	1	105	8	27
3. Do. Leaving a whip shoot alone.	2	105	10	26
4. Do. Leaving a leafy shoot and a whip shoot.	2	108	6	24
5. Do. Leaving the main shoot and an axillary leafy shoot.	2·5	110	7	25
6. Do. Leaving the main shoot and a whip shoot.	2·5	95	8	22
7. Pruning all whip shoots leaving leafy shoots.	3	108	6	24
8. Pruning all leafy shoots leaving whip shoots.	2	92	10	23
9. Control.	2·5	95	6	25

N.B.—For convenience, shoots less than 6 in. produced after pruning were not taken into account in the above data.

It is seen from the above data that *Cryptostegia grandiflora* responds remarkably to pruning, putting forth plenty of fresh growth within a short time after pruning. It was observed that the regrowths were put forth mainly from the nodes on the whip shoots. In cases where the whips are completely pruned back, the regrowths appear mainly from the base of the plant. It is seen from the results

obtained that drastic pruning of the plant induces more leafy growth and less number of whip shoots. It would appear that leafy vegetative growth is essential for the production of whip shoots in the plant. When all leafy shoots are pruned down, leaving whip shoots alone, more of leafy shoots are produced. When whip shoots alone are pruned leaving all the leafy shoots, more of whips are produced. Therefore, it appears as if there is a sort of balance between the number of whips and leafy shoots produced in a plant. The whip shoots after a certain period bend down from their erect position. When this happens, a number of shoots begin to grow on these horizontally disposed old whips. When the whips are pruned down before they bend, new whip shoots were found to grow mainly from below the pruned portions.

From these results it appears that in order to induce the maximum number of whip shoots in a plant it is essential that the leafy shoots are not removed drastically. Pruning back old whip shoots induces the production of more whips. Therefore, as soon as a whip shoot is fully tapped it is advantageous to prune it back leaving a short stump for fresh shoots to grow. Sometimes as the tapping is in progress the whip shoots bend down and a number of shoots are produced on them. Since many of these shoots have a tendency to grow whips, the older whip shoots in these cases may be suitably pruned or trailed instead of being cut back, in order to encourage the growth of these new shoots.

Further studies on the aspect of the vegetative growth of the plant with special reference to the production of whips are in progress.

DEHYDRATED BUTTER IN AUSTRALIA

SPEAKING at the annual meeting of the Producers' Cooperative Distributing Society in Sydney last week, Major J. R. King, general manager, said that the butter dehydrating plant was running at full speed all the year and gave wonderful service to Australia in removing second grade and pastry butters from the market, 'I hope that Great Britain will refuse to take our inferior butter', he added, 'and that they will be dehydrated, thus removing for all time the stigma on the quality of Australian butter in the British market caused by these lower grades'. The butter dehydration plant in Queensland is also doing a splendid job in raising the quality of second grade butter in that state.—*Dairy News Letter*, Canada, April, 1944.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. Which are improved poultry and what are its feeds ?

A. In India the term 'improved poultry' is applied to imported breeds such as White Leghorns, Rhode Island Reds, Black Minorcas, etc.

Poultry is mainly fed on cereals and their bye-products but those have to be supplemented with protein-rich supplements, green food and calcium. The optimum protein content of rations for young chickens is about 18 per cent. For laying birds and birds of 12 weeks upwards good results can be obtained with a ration containing about 15 per cent protein. A good mash for all classes of stock is as follows :

Mash :	Wheat bran	50
	Yellow maize meal	30
	Ground barley	20
	Salt	1
Chicks grain : (up to 8 weeks)	Broken yellow maize	1
	Cheena	1
	Jowar	1
Grain (8 weeks onwards)	Equal parts maize, wheat and paddy.	

From 0 to 8 weeks feed separated milk or buttermilk only to drink.

From 8 weeks onwards feed separated milk or buttermilk and water in separate containers. Succulent green food should be fed daily in liberal amount. Broken limestone of good quality or shell grit should be fed *ad libitum* to all groups.

With this method of feeding the grain is fed twice daily, morning and evening and the mash is fed *ad libitum*.

If no milk products are available good results can be obtained with meat-offal from the slaughter house. This material should be cooked for about an hour, minced and mixed up in the mash. For adult birds feed about $1\frac{1}{4}$ oz. of meat offal per bird per day. Chicks get smaller quantities of the meat-offal but the percentage of meat offal to mash and grain has to be increased.

Meat-offal feeding : Feed grain morning and evening and wet mash thrice daily. From 8 to 12 weeks feed grain twice daily and meat-offal twice daily. From 12 weeks onward feed grain morning and evening and wet mash once daily.

Q : What is the best method for absolutely and completely sterilizing milk so that if external contamination is guarded against it may remain fit for human consumption for an indefinite length of time, without including much caramalization of the milk sugar present.

A. The sterilization of milk required for human consumption has not yet come into practice in this country, as the processes employed abroad do not give the desired results under the conditions prevailing in India and need modification. The subject has now been taken up for investigation at the Imperial Dairy Institute and it will take some time before this work is completed and a suitable process for adoption under Indian conditions is evolved and standardized.

A brief idea of one of the processes employed abroad is given below. It cannot, however, be relied upon to give satisfactory results without thorough investigation :

'Milk, that is fresh, clean and pure, is standardized to the required quality and then pasteurized by the holding method (145°F for 30 minutes) and homogenized in hot condition under a pressure of 2,500 to 3,000 lb. per square inch. This processed milk is then filled into previously sterilized containers (i.e. cans) and the cans are sealed. The containers are then heat sterilized in autoclaves of rotary type under 15 lb. pressure for periods depending on the initial bacteriological condition of the milk. The containers are then cooled with cold water as quickly as possible and incubated at about 80°F for about 3 weeks to sort out the 'weeds'. The good consignments are then disposed of as desired.'

What's doing in All-India

THE PUNJAB

By P. N. Nanda, M.R.C.V.S.
Superintendent, Government Cattle Farm, Hissar

A very large number of fairs and shows are held in the Punjab during the winter months. Details of some of the more important ones are given here.

Montgomery horse show

Two hundred and sixty horses and 34 mules were exhibited. Although the number of exhibits was the smallest on record, the quality was of a very high order. The judges remarked that the number of exhibits at this show has been decreasing for many years and this year reached its lowest level of 302 against 2,433 in 1930. Dealers attended the show from all parts of India and competition for rejected stock was extremely keen. The highest prices obtained were, colt, age 11 months Rs. 4,600, and mule a year old Rs. 660.

At the Khanewal horse show, a yearling colt was sold for Rs. 1,600 and a 13-month-old mule for Rs. 720.

Some of the other important fairs held were as under :

Ser. No.	Name of Fair	No. of animals attended	No. of animals sold	Average price (Rs.)	Maximum price (Rs.)	Minimum price (Rs.)
1.	Sirsa, Hissar Dist.	4,319	2,534	—	400 (bullock) 300 (buffalo)	20 (donkey) 30 (cow)
2.	Bhiwani, Hissar Dist.	12,919	6,352	169–8	900 (bullock)	25 (buffalo)
3.	Donkey fair (Beri), Rohtak Dist.	3,875	897	—	750 (mule)	50 (pony)
4.	Meham, Rohtak Dist.	5,757	545	—	750 (bullock)	50 (buffalo)
5.	Gohana, Rohtak Dist.	16,530	1,844	—	950 (horse)	38 (buffalo)
6.	Bahadur Garh, Rohtak Dist.	22,090	2,623	—	800 (bullock)	30 (buffalo)
7.	Asuj Amawas, Horse and Cattle Fair, Taran Taran, Amritsar Dist.	6,260	3,551	241 (horses) 104 (cows)	—	—
8.	Maghar Amawas, Horse and Cattle Fair Taran Taran, Amritsar Dist.	3,837	2,217	81 (cows) 186 (buffaloes) 315 (camels)	—	—
9.	Kahna Nau, Lahore Dist.	1,400	600	500 (buffaloes) 200 (cows) 450 (horses)	—	—

In addition to the foregoing several one-day cattle shows and District Board annual cattle shows and fairs were held in the Rawalpindi Division. The average price of animals of Dhanni breed was Rs. 700 for a bull, Rs. 300 for a cow and Rs. 200 for a heifer.

BALUCHISTAN

By M. Asghar Ginai, M.Sc.(Hons.)
Vegetable Research Station, Quetta

THERE was general improvement in weather conditions in Baluchistan as compared to the corresponding periods of the previous years. Not only the winter was comparatively mild but there was good rainfall all over, which has led to better crops and vegetation. The incidence of several hail-storms in March, however, was an unpleasant feature which has done considerable damage to almonds, apricots and certain plums in the

Quetta Valley. In the uplands, the rainfall was rather late and periodical and is being availed by growers to increase the area under *Khushkaba* (rain-fed) wheat and potato.

Potato cultivation

The local potato sowing season starts in March. Owing to heavy military consumption and transport restrictions in other provinces, there was an acute shortage of potato seed in Baluchistan and special permits had to be arranged by the Local Administration for the import of 14,000 md. of potato seed from Sialkot and Meerut. Some 5,000 md. more of potato seed have been booked for Quetta by dealers on their own initiative, and about 4,000 md. of potato seed of local origin are already in the hands of the growers. The potato seed situation which originally looked rather bad is now very bright and there is plenty of seed in the local markets. The good paying harvests of the last year have given great impetus to potato cultivation and the rains are being availed of by growers to increase the area under potato.

Fruit development

The introduction of selected varieties of fruits was continued. Amongst the foreign varieties of fruits under trial at the Fruit Experiment Station, Quetta, Muir, Early Imperial, Red Bird peaches and Golden Delicious apples were specially selected for propagation in this season.

Muir is a nice yellow peach ripening in late October, when there is probably no good peach available in India. Several hundred plants of this variety have been introduced in Baluchistan and it is anticipated that this variety will grow very popular and will considerably extend the local peach season. Early Imperial is an early variety which ripens in between the early local varieties of peaches, Premier and Goulds Early, and will be popular in the local market for its handsome size, appearance and taste. Other varieties which were issued from the Fruit Experiment Station nursery in this season are as follows :

Almonds :	Thick shelled and thin shelled.
Apples :	Golden Delicious, Kandhary, Kulu.
Apricots :	Charmaghze Early, Nari, Charmaghze Late, Large Red, Luizet, Paviot.
Grapes :	Sheikh Ali, Tor, Saibi, Emperor, Olivette Blanche, Black Hamburg, Haitha, Spin Kishmish.
Nectarines :	Leppiat Late Orange, Shaleel Early.
Peaches :	Babcock, Elberta, Gaume Parvin, No. 8, Curry, Goulds Early, Krummal
Plums :	Cox' Emperor, Norman, Santa Rosa, Yellow Drop.
Pears :	Fertility, Beurre de Giffard.

Vegetable seed scheme

Quetta climate has been found very suitable for the production of seed of English vegetables. To develop this seed industry a Vegetable Seed Scheme has been started since January, 1944. As the scheme came into operation after vegetables had been transplanted by growers for seed purposes, selection and roguing was not possible in case of root crops. From the cabbage plantations several thousand stumps were removed. The presence of immature heads had to be reluctantly tolerated as drastic roguing was likely to frighten away the seed growers and hamper the development of this industry. Timely hoeing, weeding, earthing and removal of suckers was carried out under the supervision of the scheme staff. The turnips started blossoming in early March and were in full blossom at the time of hailstorms and suffered slight damage. A general survey of the existing varieties of English vegetables grown in the Quetta Valley was conducted and among others, seven varieties of turnips, four varieties of cabbages, two varieties of knol khol, four varieties of beetroot, three varieties of carrot, three varieties of lettuce, three varieties of celery, two varieties of parsley, one variety of parsnip, three varieties of leek, two varieties of table radish, one variety of Brussels Sprout, one variety of Sage, one variety of horse radish, and one variety of mint were recorded. Some of these varieties were confined to a few plants which were got transplanted for seeding and propagation.

Vegetable schemes for Defence Forces

Three hundred and twenty acres of land have been earmarked for growing of vegetables for the Defence Forces. One hundred acres of land have been put under vegetables at Sibi for the winter and early summer supply to Baldist. About 120 acres of land have been set aside at Quetta, Kuchlak, Pishin and Mastung for the supply of vegetables to Baldist and Sindist respectively. The vegetable supply started in the middle of December and 150,119 lb. of graded vegetables are being supplied every month to Baldist, and this supply is expected

to continue till the 1st week of June. These schemes have not only ensured supply of good quality vegetables for the military but have considerably checked inflation and shortage in civil markets. The Sibi scheme brought good money to the primary growers, as not only the rates offered were reasonable but the growers were saved the extra cost of marketing (transport and middle-manship) by direct supply to R.I.A.S.C. at Sibi.

Animal Husbandry

During the period under review three horse and cattle shows were organized by the Baluchistan Veterinary Department. Thirteen stud bulls of the Bhagnari breed were purchased during the Sibi Week at a cost of Rs. 6,000 to replace the old stud bulls. These have been distributed on semi-subsidiary basis amongst the cattle breeders who will be paid no maintenance allowance and the cost of the bulls will be recovered from them in instalments of Rs. 15 per mensem. Other terms of the contract which will have to be observed by the allotees are as follows:

(1) The stud bulls will be used exclusively for breeding purposes,

(2) will be available to everybody for covering free of charge,

(3) will be maintained in good condition and will be open to inspection by the Veterinary Department, and

(4) are liable to be withdrawn in case of abuse.

This arrangement will economize the expenditure on the Cattle Breeding Scheme and will enable the Administration to increase the present strength of the bulls within the allotment.

Sibi horse and cattle show

This show immediately precedes the Annual Provincial Durbar and is one of the most popular events in Baluchistan. The show was held at Sibi from 13 to 18 February and was a great success. There were 1,253 entries this year as against 765 in the previous year. The exhibits included 1,136 cattle, 89 camels, 28 sheep and 378 horses and donkeys. There was marked improvement in the quality of the cattle exhibited. The cattle brought from Sibi district were as good as those from Bhagnari. The classes for bulls, both big and small, were full, as were those for bullocks and plough cattle. The milch cows exhibited were fine specimens of the type. The unusual increase in the quality is due to overabundance of fodder in this season, production of good stock and unusual slump in the cattle market brought about by the embargo on export of cattle and probably unusual rise in prices which make it difficult for buyers within the province to purchase their requirements. The ban on the export of cattle to the Punjab has been relaxed. There is no market for camels and no purchases were made by the Military Remount Depot, this year. The number of entries for sheep in the show continued to be discouraging. The entry on the horse side showed slight increase on the previous years, though there was little improvement in the quality.

A sum of Rs. 1,583 which includes Rs. 470 contributed by the All-India Cattle show Society, was given away in prizes. The prize distribution ceremony was well attended and Lt.-Col. W. R. Hay, the Hon'ble the Agent to the Governor-General, Resident and Chief Commissioner in Baluchistan, gave away the prizes.

Usta horse and cattle show

Usta Colony is a very important tehsil of the Sibi district and embraces the major wheat growing tracts of Baluchistan fed by Khirtar Canal. A horse and cattle show was held at Usta Mohd.—the centre of this colony—on 9, 10 and 11 March, 1944. The exhibition included fine specimens of cattle of Bhagnari breed, Balochi and T.B.E. types of horses, and mutton sheep. The cattle especially those of Bhagnari type showed definite improvement as compared to many previous years. The distribution of five stud bulls amongst the zemindars of Usta Mohd. tehsil and four bulls in the nighbouring tehsil of Jhatpat is expected to lead to greater improvement in the quality of the cattle. Rs. 278 and Rs. 286 were given away as prizes to cattle and horses respectively.

Gumbaz horse and cattle show

A third horse and cattle show was held at Gumbaz in the Loralai district on 17, 18 and 19 March. The exhibits consisted of cattle, horses, camels and sheep. Entries were good and there was keen competition amongst the participants. The Afghan Pavindas who had abstained from exhibiting their sheep in the last year, also participated and were allotted separate classes.

The Duki Sub-division of the Loralai district is well-known for the quality of horses which are highly esteemed amongst the Kakars and Pavindas for their exceptional high speed and endurance. The cattle show at Gumbaz consisted mostly of Lohani type which is a small hard-hoofed cattle probably used for ploughing in stony and hilly tracts.

ASSAM KEEPS GOING

By F. S. Gregory

Chairman, Cattle Improvement Association, Panitola Circle, Assam

INCREASE shown in cattle population, so essential to the Grow More Food Campaign, despite the present unfavourable circumstances of the tea estates which are members of the Tea Estates Cattle Improvement Association, Panitola, is a striking feature of the 3rd Annual Report of this Association.

There was an increase of 153 in the cattle population of the circle. The increase would have been much higher during the year, had there not been a great demand for cattle at high prices for the purpose of slaughter and several cases of cattle lifting. But on the other hand considering the severe loss of grazing grounds which are rapidly dwindling on many of the gardens, and the non-availability of land for fodder crops, a heavy increase in the numbers of livestock would merely have accentuated a problem which has already assumed alarming proportions.

As the war continues, conditions for cattle improvement steadily deteriorate and it is becoming more and more imperative to keep the Association running in the interest of the members and to have a working organization in existence when peace returns.

Fortunately during the year there were no widespread epidemics in any of the gardens, and with the exception of a few isolated cases for which the usual measures were taken, the year could be regarded as a fairly good one from the health point of view. There was an outbreak of foot-and-mouth disease during the last monsoon in some of the gardens but no deaths were reported. Preventive measures were taken and 5,751 animals were innoculated against rinderpest and anthrax.

Thanks to the energetic efforts of the Director of Agriculture, whose assistance and advice are always so readily forthcoming whenever asked for, the association were able to obtain six bulls for allocation to members. This brings the total number of bulls in the possession of the Association to 42. One hundred and fifty-one calves were born during the year. Four hundred and eighty bulls were castrated.

High prices

Lack of grazing ground, non-availability of land and heavy demand for cattle have resulted in steady increase in prices all round. In the pre-war period a pair of draught bullocks could be had for Rs. 50 to 60 whereas now the price has risen to Rs. 150 to 200. Similarly milch cows yielding about 1 seer of milk per day are now being sold at Rs. 50 as against the old price of Rs. 20.

Owing to the present conditions it has not been possible to hold the annual show which undoubtedly has a big propaganda value. More and more labourers are, however, asking the Inspector for his opinion about their calves in regard to their suitability for show purposes. The last show was very successful and aroused good deal of interest among the villagers and labourers and so long as we are unable to hold another we shall be without what is perhaps the most important feature of our scheme from the point of creating and maintaining interest and the necessary incentive to greater efforts.

From 1 July 1942 the subscription for the membership of the Association was reduced from Rs. 12 to Rs. 6 per month due to the satisfactory cash balance in hand and restriction of activities owing to existing conditions.

MILK RECORDING NEWS

RECORDS have been received from five village milk recording schemes—three for the lactations completed in Feb. 1944 and two for lactations completed in March 1944. The average lactation yield for cows (29 records) was 2,104 lb. and for buffaloes (3 records) 1,581 lb. Records for each breed are given below :

Sindhi cows

Malir area, Karachi, Sind. Three cows completed their lactations during February 1944 yielding 3,515 lb., 3,325 lb. and 2,440 lb. The records are given below :

Name and number of cow	Name of breeder	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
Dali 17	Sabu S/o Jiand	4	3.4.43	303	2515	18
Rojhi	Mohammed S/o Punchoo	4	4.6.43	250	3325	17
Kanai 72	Mohammed S/o Punchoo	2	26.6.43	234	2440	19

Kankrej

Sanand area, Ahmedabad district. Ten cows completed their lactations averaging 1,969 lb. with a maximum yield of 3,006 lb. and minimum yield of 1,366 lb. Selected records are as under :

Name of cow	Name of owner	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
Bhil	Rabari Rama Vaha	1	20.6.43	249	2145	13¼
Dhoyadi	Rabari Valji Govind	—	20.4.43	302	3006	13¾
Zerki	Rabari Veshi Bhatt	—	22.4.43	302	2361	12¾
Dhoyadi	Rabari Sarlan Sandha	2	24.5.43	261	2237	15½

Hariana

Beri area, Rohtak district, Punjab. Records for 20 cows that completed their lactations in February 1944 were given in the last issue. Three more records have now been received.

Brand No.	Name of breeder	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
DG/7	Kurra S/o Rambhagat	5	30.6.43	238	3,270	23
MM/1	Mange S/o Ganga Sai	4	2.7.43	207	2,686	17
PL/12	Sewa Ram S/o Nand Ram	6	25.6.43	240	2,976	19

Local cattle

Trivandrum area, Travancore State. Nine records have been received for lactations completed in February and March 1944. The average yield was 1,722 lb. The maximum yield was 3,363 lb. and the minimum yield was 616 lb. Selected records are given below :

Brand No.	Name of breeder	No. of lactation completed	Date of calving	Date of drying	Days in milk	Lactation yield lb.
TR.264	Chellappan	3	19.5.43	11.2.44	268	3363
TR.266	Chellappan	3	15.7.43	13.2.44	208	2127
TR.253	Karthayani Amma	4	2.6.43	5.3.44	273	1815
TR.270	Convent	3	12.7.43	7.3.44	235	2428

Local cattle and buffaloes

Chata area, Muttra district, United Provinces. Three cows and four buffaloes completed their lactations during March 1944. The average yield for cows was 1,581 lb. and for buffaloes it was 1,899 lb. Selected records are as under :

Brand No.	Name of breeder	No. of lactation completed	Date of calving	Days in milk	Lactation yield lb.	Maximum daily recorded yield lb.
259 Cow	Natthi	1	27.6.43	263	1635	9·0
158 „	Dharam Pal	2	18.4.43	321	1527	7·5
304 Buff.	Ramfal	1	1.8.43	228	2405	13·0
253 „	Garhidadi (S. 1)	4	26.7.43	236	2032	12·0
293 „	„	1	25.8.43	195	1615	12·0

The Month's Clip

SCIENCE AIDS FOOD PRODUCTION

By Sir R. George Stapledon, C.B.E., F.R.S.

THE magnitude of the task set the British farmer, when, at the beginning of the war, he was called upon to embark on an all-out campaign of food production, is not easy for our allies and friends fully to realize. The preponderate acreage in Britain in times of peace is always permanent grass, that is to say, fields not brought into a rotation of tillage crops, and that have stood in grass for over 20 years, and many of them for much longer periods, while certain areas of alluvium have probably never been under the plough.

In addition to permanent grass, Britain is remarkable for a very large area in rough grazings. Rough grazings are areas that have never been ploughed, and that receive no manures or attention except in some cases for periodic burning—they are used as grazings for cattle and sheep. Before the war, rough grazings contributed nearly one-third to the land surface of Britain. The extent of our rough grazings is, in part, due to the fact that we have not developed as vigorous an afforestation policy as other European nations, and, in part, to the exposed and difficult nature of most of the country occupied by these grazings—a large proportion of it standing above the 1,000 ft. contour.

Tractors and better technique

In this war, however, the farmer has been able to break up his permanent pastures as well as a tilling acreage of rough grazings with much greater speed and to altogether better advantage than in the war of 1914-18. Indeed, in 1914-18 we made no attempts to bring the rough grazings under cultivation. This has been due to two main causes, in particular the facilities afforded by modern tractors and tractor-implements, and to improved technique.

Great advances had been made in Britain since World War 1 in the organization of agricultural research. By 1939 we had our chain of research stations and advisory centres. One result of this has been that before the present war, a good start had been made with a soil survey of the country and a number of sample areas had been completed, while, just before the war, a survey of the grasslands of England and Wales had also been completed.

At the outbreak of the war, Britain had a sound nucleus of well-trained agronomists and soil chemists, and a fair knowledge of the soil and cultivation problems with which we should be faced. Steps were immediately taken to strengthen and increase the indoor laboratory staffs and the outdoor agronomists. The result has been that reliable advice has been available as to the manurial treatments necessary on the different classes of permanent grass and rough grazings brought into cultivation and as to cultivations and cropping.

So far, something of the order of 6,000,000 acres of permanent grass and rough grazings have been brought under cultivation, and the soil from representative individual fields and areas totalling something like 1,000,000 samples have been examined, analysed and reported upon.

High yields from poorest land

Because of all this work, in a high proportion of the fields brought under the plough the manurial dressings have been sensibly applied. The right manures, supported by correct cultivations, has led to what the farmers have considered to be surprisingly high yields from land in the poorest of grass or in a semi-derelict condition. It is, indeed, true to say that the yields of wheat and other crops have been much higher and much more certain than was the case during our corresponding efforts in 1914-18. This, to a considerable extent, has also been due to the better varieties of the several crops now at the farmers' disposal.

A matter of outstanding importance has been recognition of the low lime content of so much of the land in Britain, and particularly that in the West and North-West—although there are no countries in Britain without large tracts of lime-deficient land. Thus, a striking feature of our war production effort

has been a concerted effort at liming on a regional basis.

The advice of the chemists has been acted upon, with the result that everywhere the dressings have been applied to the best advantage and in proper relationship to the needs of the soil. Before the war, it is doubtful if the annual dressings of lime, reckoned as CaO, exceeded about 300,000 tons per annum, while the amount used during 1943 probably amounted to something like 3 million tons of CaO.

Even this large increase is, however, far from sufficient to rectify the lime-status of the huge acreage of lime-deficient soils of the country as a whole, while it is probable that the annual requirement for maintaining the lime-status of our soils due to wash-out is as high as 2 million tons per annum.

The point here to be emphasized is, however, the fact that a very large proportion of the land brought under the plough has been limed in proper sympathy with its lime requirements. By adopting careful methods of rationing and again following closely the advice of the chemists, we have made excellent and economic use of all the phosphate manures that it has been possible to make available—the British soils as a whole run decidedly deficient in phosphates.

Scientific use of fertilizers

Another factor making for high wartime yields has been the abundant and scientific use of the inorganic nitrogenous fertilizers—for the most part ammonium sulphate. Our yields of wheat, in particular, have greatly benefited from late spring applications of ammonium sulphate and such dressings have been very general.

It will be of interest to conclude this article with examples of yields that have been obtained as a first crop from very poor permanent grass and various classes of derelict land.

Potatoes: On bracken land (rough grazings) in Montgomeryshire (in Wales) with adequate liming and the proper use of artificial manures, yields of from 10 to 13 tons per acre have been obtained at between 1,200 to 1,300 ft. above sea level.

Wheat: In Warwickshire, very poor permanent pasture ploughed out in June and drilled to wheat in October, with the aid of phosphates, and of nitrogen given in May, have yielded well over 28 cwt. per acre as a first crop, followed by a second crop of very little loss.

Oats: Have been extensively grown as a first crop on much reclaimed acidic moorland, and with proper cultivations and manures have yielded (first crop) from 20 to 25 cwt. per acre.

Direct re-seeding: Much of the poorest steep and difficult land has been ploughed and directly re-seeded to grass. To achieve success lime is absolutely essential. Experiments in Midlothian (Scotland) showed in terms of live-weight increase of sheep per acre :

Re-seeded without lime—292 lb. per acre.
,, with ,, —393 lb. per acre.

These typical results show that the British farmer and the scientist have worked harmoniously together and by their co-operation have reached a high measure of attainment in the nation's food production campaign. Our effort has been successful both quantitatively, in terms of acres brought into cultivation, and qualitatively, in terms of yields per acre.

CANKER IN THE ORCHARD

PRUNERS like to work together, working down rows so that they can talk and keep in touch with one another. A pruner who finds that he has numbers of cankers to cut out is apt to skimp the work so that he can keep up with the others, rather than have to lag behind, cutting out all the cankers properly. If, however, two men or women are set aside for this special job, there is little doubt that the cankering will be done effectively. Two W.L.A. girls could easily be instructed in this work and this would be their sole job for as long as the work lasted.

Not only will gouging have to be done, but the sawing out of whole branches will be necessary, in bad cases. A bad wound may have eaten its way almost right the way round a branch, and as a result any fruit borne next year may prove too heavy a weight and the branch will snap off at the wound. The cankerers should have a fire going so that as much as possible of the cankered wood can be burned. It is possible, where canker is not too widespread, to carry braziers for this very purpose. On cold days no girl will need to be encouraged to adopt the brazier habit. Latterly, a number of fruit growers to whom I act as adviser have found that a substance called Medo gives good results. This Medo, which appears to be a special type of tarry substance, is applied to the canker wound

with a stiff brush. There is no need to do any prior paring or cutting. It seems that the canker fungus is destroyed, with the result that new growth develops the following year. I have not, of course, had the opportunity of trying it out under all conditions, but to date it seems very satisfactory.

Canker may enter the young twigs of apples through the cracks caused by the scab fungus; for this reason alone it is most important to carry out the routine sprayings with lime-sulphur just before the blossoms open and again after the blossoms have fallen. It invariably seems to follow a bad attack of woolly aphis and this pest should, therefore, be kept down at all costs by a thorough soaking in February of di-nitroortho-cresol, followed by sprayings, if necessary of liquid derris I.T.P. A number of varieties are particularly susceptible to the disease. They include Warner's King, Lord Suffield, Grosvenor, James Grieve, Cox's Orange Pippin, and Worcester Pearmain. Among the cider apples, Cap of Liberty and Kingston Black, are particularly bad. Certain stocks seem to have a bad effect on trees, making them more susceptible to canker. No. 4 and 7 are definitely under suspicion, as well as Nos. 16 among the stronger stocks. There are a few varieties of apples which seem more resistant. For instance, Lane's Prince Albert, Newton Wonder and Bramley Seedling, and among the 'ciders' Silver Cup, Royal Wilding, and Ellis Bitter.

Naturally, trees that are not in the healthiest of condition seem more predisposed to canker than those which are really doing well. For instance, it has been shown that canker is very prevalent on the low lying ill-drained soils, as well as in orchards where there is a heavy, somewhat sodden, subsoil. When orchards are over liberally manured with nitrogen, the trees seem to suffer more with canker than if the manurial programme is properly balanced and adequate supplies of potash are made available. It is possible in very bad cases of stem or trunk canker to bridge graft over the wound in order to save the tree. This bridge grafting should be carried out early in April, using much longer scions than are usually employed. In addition it is advisable to support the tree with stakes so as to make certain that it cannot move and so snap off at the wound. Two or three bridge grafts will bring a tree back into normal cropping in two or three years time.—W. E. SHEWELL-COOPER, *The Field*, 11 December, 1943.

FOOD STANDARDS FOR HEALTH

WITHIN the last generation science has given us a new body of exact knowledge about human and social needs. We now know, as men in earlier years did not know, something about basic requirements in food, housing and town planning, clothing, rest and education. We know more in some of these fields than others, and we have not got quite beyond the stage of controversy in any of them. But we are beginning to feel firmer ground under our feet than ever before; and we are beginning to appreciate that the area of firm ground will increase steadily, as scientific method is extended in the sphere of physics, chemistry, biology, psychology and the social sciences.

What is the character of this new scientific knowledge about human needs? It is at its most advanced, most exact and least controversial in the field of diet. Not all scientists are agreed about the correct standards. That would be asking too much of human nature. But within fairly narrow limits they do claim to know what diet is necessary to existence and — a different matter—for good health. Moreover, what the biologists have discovered in the laboratory has been grimly documented by the social scientists. They have told us that in Britain, one of the wealthiest communities in the world, nearly half the population a few years before the war had a diet below the minimum needed for health. We know also that startling results on the health of adults and the growth and health of children have followed on simple improvements in diet made under controlled conditions. Finally, the great experiment made possible by the war itself has demonstrated triumphantly that a people living on a diet more restricted in bulk and variety, living too in conditions of great strain and dislocation, can actually be healthier than before, when steps are taken to ensure that the food they do get contains the right proportions of those ingredients needed for healthy living. The scientists would be throwing up their hats over this resounding demonstration of the validity of their theories—if scientists did that sort of thing. Perhaps they will say that they leave it to the politicians.

But the improvement in national health during the war must not blind us to the fact that we are, partly through ignorance, partly through poverty, still well below an optimum food standard, and that health, growth and expectation of life would all be greatly improved if we could attain that standard.

If that is true of a community like our own, picture the gap that exists between fact and ideal in the world as a whole. Consider the implications of the fact that Africa and Asia, containing over 60 per cent of the population of the world, enjoy about 27 per cent of its supplies of cereals (including rice) and about 9 per cent of its meat. The percentage figure for milk, if we had it, would be lower still.

I cannot do better than end these remarks about food standards with a sentence written by two scientists, Bacharach and Drummond: 'If the whole of the human race, after making due allowance for any effects of different climatic and geographical conditions on maximum health, could by some stroke of the pen be possessed of, and persuaded to eat, a diet constructed on the lines indicated here, then the consequent change in human health, and the resultant change in human society, would be the profoundest that have ever occurred in the history of mankind'.—RT. HON. HERBERT MORRISON, P.C., M.P., at the meeting of the British Association, September, 1941, *The East African Journal*, January 1944.

ROTATIONS FOR DARK TOBACCO

LOAMY soils as a rule produce the best quality dark tobacco. While these soils are naturally quite fertile their productive capacity depends on the programme followed to maintain a high level of active soil organic matter.

Experiments conducted over a period of years at the Dominion Experimental Station, Harrow, Ontario, indicate that while barnyard manure and commercial fertilizers are both highly essential in maintaining an adequate supply of active plant food for dark tobacco, the principal value of these materials is not fully realized until proper consideration is given to crop rotation. The duration or length of the rotation and the crop sequence were found important in planning a rotation for dark tobacco. Most of the soil-borne diseases of dark tobacco were kept within reasonable control, particularly if proper consideration was given to the arrangement of the crops in the rotation.

In a five-year rotation the crop sequence showing best results at Harrow was tobacco, corn, oats, wheat, and alfalfa. Barnyard manure was applied for the tobacco at the rate of 15 tons per acre on the alfalfa sod, usually in the fall, and spring ploughed. The tobacco also received 1,000 lb. of a well-prepared tobacco fertilizer. The corn crop received a 10-ton application of barnyard manure. This procedure not only was effective in maintaining satisfactory yields of good quality dark tobacco but also was highly beneficial to the production of the intervening crops in the rotation.—*Department of Agriculture, Canada*.

MINERALS FOR LIVESTOCK

TWELVE or 13 mineral elements are recognized as essential in the diet of farm animals. Ordinarily they can be supplied in ample quantities by careful selection of feedstuffs. Sometimes, however, special mineral supplements are needed but only the specific minerals that are deficient need be supplied. Feeding an excessive amount of minerals or a complex mineral mixture when it is not required is expensive and wasteful and may be harmful to the animals. Some minerals, such as selenium and fluorine salts, are toxic even in very small quantities, says Leonard Griesbach, Dominion Experimental Station, Fredericton, N.B.

Salt is one of the essential mineral compounds most likely to be lacking in the diet of farm animals. Fortunately, it is one of the easiest and cheapest to provide as a supplement and a deficiency can be avoided by giving herbivorous animals free access to salt regularly. Pigs have a low salt requirement and the amount supplied by most protein-mineral mixtures is apparently sufficient.

Young stock and cows in milk have a high calcium and phosphorus requirement. Grains and mill feeds are relatively rich in phosphorus but low in calcium. Good quality hay, especially that made from legumes, is rich in calcium but may be low in phosphorus. Milk is rich in both of these minerals. If there is reason to suspect a deficiency of these minerals in the diet, a mineral supplement should be fed. A simple mixture that has been used at the Dominion Experimental Station, Fredericton, N.B., with satisfactory results is made up of equal parts steamed bone meal or bone char, ground limestone and iodized salt. This supplement may be added to the meal mixture at the rate of 2 lb. to each 100 lb. of meal or

it may be fed as a lick.—*Department of Agriculture, Canada.*

MORE LAMBS PER EWE

THE grain farmer naturally wants high yield per acre, and likewise the sheep breeder should want high yields for each breeding unit in his flock if he wishes to make good profits. Overhead charges are the same per breeding ewe regardless of how many lambs she produces and feed costs are practically the same regardless of production, says Dr. K. Rasmussen, Dominion Experimental Station, Lethbridge, Alberta. The net profits depend on the number of lambs produced for sale. The average rate of production is only about 80 weaned lambs per 100 breeding ewes on the ranches of Alberta and Saskatchewan. This is much below the productive ability of the ewes, as studies at the Lethbridge Experimental Station have shown that ewes of the breeds commonly used are capable of producing well over 100 lambs per 100 breeding ewes.

The difference lies in the care and management the sheep get previous to breeding time, during the breeding season, during the winter after breeding, and at lambing time. A few changes in management may easily lead to a big improvement in the lamb crop.

The first step is to cull the ewes severely in the fall before breeding. Obviously any ewes that are not strong and healthy cannot be expected to produce healthy lambs. On the other hand the fattest ewes may be ewes that have not produced lambs and the chances are that many of them never will. Just because a ewe is a little thin after working hard at raising a good lamb she should not be culled, but it would be better to get rid of those that have been loafing at the job and have not produced a lamb. Care should be taken to remove all ewes that during the past season have had trouble with their udders and those that have been poor milkers and have not made a good job of raising their lambs. A good herder will spot such ewes during the spring and summer and they can be marked when observed. This is a more accurate way of culling than is usually done with a chute and cutting gate.

The ram is highly important in obtaining a good lamb crop. A little extra feed before and during the breeding season will ensure this. The number of rams used has a direct bearing on lambing results and generally speaking three rams per 100 ewes is a good ratio. The rams should not be given continuous service but given periods of rest and given some extra feed. This can be done by alternating the rams placed with the ewes or by taking the rams away from the ewes for a portion of every 24-hour period. Some farmers prefer to leave the rams with the ewes during the day and take them out at night, whereas others use the reverse order.—*Department of Agriculture, Canada.*

New Books and Reviews

WARTIME PRICES

By P. J. Thomas (Oxford University Press, 1943, pp. 32, As. 6)

THIS is a small pamphlet of 32 pages in the series 'Oxford Pamphlets on Indian Affairs' in which the author discusses the causes of wartime rise in prices and the measures taken by the Government to check the inflationary tendency, and suggests certain steps which the Government and people should take to enhance India's prosperity in the post-war period.

The expansion of the currency and the diminution in supply of goods available for civilian consumption contributed so largely to the phenomenal rise in prices, the position being aggravated by hoarding and speculation. The Government measures were designed to drain off the surplus money by borrowing and taxation. The borrowing programme included issue of various types of loans and the taxation took the form of increase in Income Tax, Levy of Excess Profits Tax, and new Excise Duties, etc. These were followed by more drastic action including ban on forward transactions, capital issue control order, anti-hoarding and profiteering ordinances, and restrictions on advances against commodities etc. In the author's opinion, the voluntary savings schemes did not immobilize much money, and taxation affected only a small proportion of the population as agricultural income is not liable to taxation. He suggests that a scheme of compulsory savings should be devised for the agriculturist classes or alternatively agricultural incomes should be taxed. To the nation, his recommendation is to put off buying as far as possible and adopt the American motto:

Use it up, wear it out
Make it do, or do without.

After the war, he goes on to say, goods will be plentiful and cheap, and what we save now will enable us to raise our standard of living. The expanded currency can then be made an asset of great value towards fuller utilization of India's large resources. India can then become a United States of the east with a prosperous countryside, an advancing industrialization, a growing purchasing capacity and a rapidly rising standard of living.

The pamphlet is written in a lucid style and provides interesting reading. The three tables giving movement of currency and prices, index numbers of wholesale prices and working class cost of living indices, provide useful information in a handy form.—B.P.B.

ECONOMIC UTILIZATION OF INDIAN LIMES

By S. S. Bhat (Sadhana Press, Raopura, Baroda, 1943, pp. 40)

THIS is a small pamphlet of 40 pages. It contains useful information about utilization of Indian limes.

This pamphlet gives details of the investigations on the economic utilization of Indian limes carried out during the years 1937 to 1943 at the Agricultural Departmental Laboratory, Baroda. These investigations show that every part of *kagzi* lime which at present fetches a very low price during harvest season can be preserved and sold with profit. The author states that the lime fruit yields 65 per cent raw juice and 25 per cent clarified juice. The average yield of lime oil amounts to 7·1 lb. per ton of limes. The peel is utilized in preparing powder and pickles. The residue is used as metal polish.

The pamphlet is partly illustrated and gives 12 tables and three photographs. The tables fully explain the economic value of lime products and the photographs show the apparatus used in preparing these products. The pamphlet gives some useful information on the subject of 'Economic Utilization of Indian Limes', although some of the figures do not hold good at the present moment due to inflated prices of these fruits in the market due to war conditions.—G.S.C.

From All Quarters

BETTER FARMING RESULTS

NOTWITHSTANDING difficulties due to war, such as high cost of manures, cattle, labour and transport as well as the scarcity of iron for farm implements, I and other neighbouring ryots in my village, Gundavolu, Rapur taluka, Nellore district, are cooperating with the agricultural department in effecting the following improvements advocated by the department.

		Total gains		
		Rs.	A.	P.
1.	In my village we could plough this year 10 acres of land with improved ploughs and this showed an economic saving of as. 12 per acre.	7	8	0
2.	In 45 pits cattle manure was preserved against the sun and rain and the value of every cartload of this manure increased by as. 8.	22	8	0
3.	In addition to 10 cartloads of cattle manure that are usually applied per acre in the village, 200 lb. of oilcake were applied at an extra cost of Rs. 10 per acre. An increased value of Rs. 4 per acre was received after deducting the extra cost of Rs. 10 spent on oilcakes. This method was adopted over 6 acres.	24	0	0
4.	Thirty-two acres of an improved strain of paddy Co.15 got us per acre a net gain of Rs. 14 over the local variety.	448	0	0
5.	So also 2 acres under improved strains of *ragi* brought us Rs. 12-8-0 extra per acre.	25	0	0
6.	Five acres sown with pure seed of *jonna* selected from our fields brought an extra yield of Rs. 4 per acre.	20	0	0
7.	We grew a mixed crop of *arika* and *daincha* in unirrigated lands and secured 120 lb. of *daincha* seed from 4 acres, without any decrease in yield of *arika* in spite of adverse seasonal conditions. With this seed we raised a good green manure crop over 6 acres showing thereby an economic saving of Rs. 6 per acre over our local methods of manuring.	36	0	0
	We divided our unirrigated field measuring about 34 acres into plots by putting up new *bunds* to prevent soil erosion and for conserving moisture. *Jonna* was grown. The extra yield was valued at Rs. 10 per acre.	340	0	0
9.	We are now having vegetables in our back yards. We grow brinjals, tomatoes, gourds and leafy vegetables; we get plenty of fresh vegetables every day. We do not sell the surplus; but often send them to our friends and relatives.	—	—	—
10.	*Jonna* seed treated with sulphur smut and sown in 20 acres gave us a net gain of Rs. 2 per acre.	40	0	0
11.	Eight acres of chillies sprayed twice with tobacco decoction against thrips attack fetched us an extra income of Rs. 20 per acre over untreated crops.	160	0	0
	Total	1123	0	0

The area on which we effected the above improvements is 60 acres dry, 10 acres garden lands under lift irrigation and 40 acres wet under rain-fed tank—M. PICHI NAIDU, Landlord, Gundavolu village, Rapur taluka.

STANDARD OF LIVING

IN the June[1] number of Indian Farming, the Editor lays it down that no improvement is possible in village life without putting more money into the pockets of the villagers.

Will he then please explain why people refuse to do the simple things which cost little or no money but will vastly increase their wealth or save them great losses—e.g. digging pits, segregating newly acquired cattle, weeding fields, checking crop pests, growing new and profitable crops, terracing and embanking their fields and so on.

No active social worker will endorse the opinion that an increase of wealth is the prerequisite of improvement. The first prerequisite is a desire for better living and until that desire is strong enough to make people give up old habits, and at the same time work and sweat, save and scrape as well as deny themselves present luxuries for future benefits and security, so long will we go on beating our heads against the stone wall of their apathy, indolence and conservatism. Without such a spur people just will not do the work necessary to increase their wealth.

[1] INDIAN FARMING Vol. IV, No. 6 p. 279.

People sometimes say that the villagers are blind or indifferent to their welfare. They are not. We have never touched the springs of action. We have never convinced them that better things are possible and practicable and desirable. This materialistic creed has been holding back progress all these years, as those who hold it control the money and the administration, and will not listen to the field workers who by long experience have learnt the truth that the best and greatest stimulus for human action is not material but spiritual.

Another fact is also true, that economic improvement does not of itself lead to social improvement. Violent crime is generally far more serious in wealthy than in poor districts. A well-known coal company in its annual report the other day said that whenever wages were raised labour started absenting itself because it was content with its present standard of living. This is a very general complaint of course. Not only is the desire for better things the strongest incentive to economic improvement but if economic improvement comes of itself, such as the raising of wages or the opening of canals it might lead to idleness, vice, luxury and extravagance but not necessarily to a really better and higher standard of living.

There are plenty of people who could not make much improvement without an increase of income, but there are also quite a lot who, if they so desired, could greatly improve their standard of living without any increase of income—look at the money still wasted on all kinds of extravagances, litigation and even positive vices and there is none who could not make some improvement, cleanliness for instance—without an increased income. Standards of living are not measured by expensive weddings, crowded law courts, ornaments or fine clothes. If only those who could, would get on with exchanging wasteful luxuries and unnecessary and even harmful things for the real things that bring light and sweetness into life, they would both stimulate the poor to do the work and undergo the self-denial necessary to achieve a higher standard of life and they would enable us to find and relieve the hard core of genuine poverty among the many whose low standards are more often due to ignorance, apathy and idleness.—COL. F. L. BRAYNE, C.S.I., C.I.E., M.C.

NEW SOIL MIXER

Mr J. D. McLaughlin, Agricultural Commissioner, West Virginia State U.S.A. has announced that he has invented a 'soil mixer' which will prepare a seed bed twice as good as can be made with existing equipment at a rate of 4 acres daily. He added that his machine prepares ground for seeding at a fifth of the cost of using plough, disc, harrow, and other ordinary tools.—*Commerce*, 8 July 1944.